TIMBER SUPPLY BRANCH

# TIMBER SUPPLY REVIEW

## Williams Lake Timber Supply Area Analysis Report

September 2001

BRITISH COLUMBIA

Ministry of Forests

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# Williams Lake
# Timber Supply Area
# Analysis Report

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# Preface

This report contains a timber supply analysis and a socio-economic analysis and is part of the provincial Timber Supply Review carried out by the British Columbia Forest Service. The purpose of the review is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting in timber supply areas (TSAs) and tree farm licences (TFLs) throughout British Columbia.

To determine allowable timber harvesting levels, the chief forester must have an up-to-date assessment of the timber supply, based on the best available information and reflecting current management direction. **The report that follows provides this assessment but should not be construed as a recommendation on permissible harvest levels.**

This report focuses on a single forest management scenario — current management practices. Current management practices are defined by the specifications in management plans for the timber supply area including guidelines for the protection of forest resources, the *Forest Practices Code (FPC)* and official land-use decisions.

Focussing the assessment on the implications of current practices rather than looking at a number of different management regimes expedites the analysis process, allowing analysis of all TSAs in the province on a regular basis. An important part of these analyses is an assessment of how results might be affected by uncertainties — a process called sensitivity analysis. Together, the sensitivity analyses and the assessment of the effects of current forest management on the timber supply form a solid basis for discussions among stakeholders about alternative timber harvesting levels.

In addition to having an up-to-date assessment of timber supply when setting the allowable annual cut (AAC) the chief forester considers short- and long-term implications of alternative harvest levels, capabilities and requirements of existing and proposed processing facilities, and the social and economic objectives of the Crown. The socio-economic analysis provides the chief forester with some of the information necessary for these considerations.

The socio-economic analysis considers forestry activity associated with the harvesting and processing of timber harvested from the TSA within the context of regional timber supply and production capacity.

This report is the third of five documents that will be released for each TSA as part of the Timber Supply Review. (The first two documents are the information report and the data package.) A fourth document called the public discussion summarizes the technical information contained in this report, and provides a focus for public discussions of possible timber harvest levels. The fifth will outline the chief forester's harvest level decision and the reasoning behind it.

# Executive Summary

As part of the provincial Timber Supply Review, the British Columbia Forest Service has examined the availability of timber in the Williams Lake Timber Supply Area (TSA). The analysis assesses how current forest management practices affect the supply of wood available for harvesting over both the short (next 20 years) and long (next 250 years) terms. It also examines the potential changes in timber supply stemming from uncertainties about forest growth and management actions. **It is important to note that the various harvest forecasts included in the report indicate only the timber supply implications of current practices and uncertainty. As such, the forecasts should be used for discussion purposes only; they are not allowable annual cut (AAC) recommendations.**

The Williams Lake TSA is comprised of three forest districts, Chilcotin, Williams Lake and Horsefly and covers about 4.9 million hectares of area in the central portion of British Columbia. Within this area, 3.15 million hectares are classified as productive forest managed by the British Columbia Forest Service. About two-thirds of this area, or about 2.1 million hectares, are considered available for timber production and harvesting under current management practices. The two factors that most significantly reduce the availability of the productive forest for timber supply are low site productivity, and an expectation that a stand will not achieve the minimum merchantable volume. These stand types make up 6.6% and 7.2% of the productive forest area, respectively. Environmentally sensitive areas, steep slopes, currently unharvested stand types, caribou no-harvest areas, recently designated parks and wildlife tree retention each reduce the productive forest available for timber supply in a range of 2-4%.

Within the area available for timber harvesting, most forests are dominated by lodgepole pine. There are also large areas of Douglas-fir in the Williams Lake and Chilcotin Forest Districts, and spruce and balsam stands, which are found pre-dominantly in the Horsefly Forest District. About 22 per cent of the current AAC is partitioned to salvage harvesting in mountain pine beetle attacked stands. Salvage has been on-going since 1985. About 13% of the current timber harvesting land base still has some level of mountain pine beetle attack resulting in some reduction to the amount of timber that is available for harvest. The inventory volumes for stands above 60 years of age have been adjusted to reflect information drawn from samples collected for the inventory audit and vegetation resources inventory.

The timber supply outlook in the Williams Lake TSA has changed significantly with the redefining of merchantability criteria from age-based maturity (i.e., 80 years for pine and 120 years for other species) and geographic locations used in the last timber supply analysis, to volume and height requirements. This change, based on an operational review, has contributed to an increase in the timber harvesting land base (almost 26%) and to greater timber supply flexibility due to a reduction in minimum harvestable age for most timber types. While the land base impact is large, it is important to remember that the previous AAC determination included a partition to harvest certain forest types which were not part of the timber harvesting land base used in the last analysis.

The base case harvest forecast provides the highest possible medium-term harvest level while maintaining a long-term harvest level which reflects the productivity of the timber harvesting land base. The base case forecast begins with a harvest over the first five years at about 3.765 million cubic metres per year, slightly below the current AAC. The harvest level is projected to decline in the sixth year by 22% to a mid-term harvest level of 2.92 million cubic metres per year corresponding to the cessation of salvage harvesting in low volume pine stands that were attacked by the mountain pine beetle during the infestation of the 1980s. The current beetle infestation in the Cariboo Forest Region is being monitored to assess its implications for the Williams Lake TSA, and any new information will be considered by the chief forester in his AAC determination.

An increase to a long-term harvest level of 3.25 million cubic metres per year occurs in decade 18, just over 170 years from now. The rise to the long-term harvest level coincides with harvesting managed stands that are closer to their maximum average productivity. Note that a correction to the base case is required. After initiation of the analysis, the volume adjustment factor for pine stands outside of the IDF and SBPS biogeoclimatic zones was changed, which increased the medium-term timber supply by 80 000 cubic metres per year in the main TSA.

# Executive Summary

There are four partitions within the current AAC. The partition of 107 000 cubic metres per year for the Pulpwood Agreement (PA) 16 area can be maintained for 30 years. The base case projects salvage harvest of mountain pine beetle attacked stands to be about 595 000 cubic metres per year of live-tree volume (not including any dead trees that may still have commercial value and would contribute to the partition volume) while the partition is currently set at 850 000 cubic metres per year. The conventional harvest in the main TSA is projected to be slightly above the partition of 2.5 million at about 2.515 million cubic metres for the first five years followed by a decline of 11% to about 2.33 million cubic metres. The harvest over the first five years in the three western supply blocks is projected at about 548 000 cubic metres per year before rising to about 589 000 cubic metres per year for the medium-term.

The timber supply in the main TSA with its extensive harvesting history tends to be more sensitive to changes in forest cover requirements than the western supply blocks. The main TSA is also more sensitive to a shift from oldest first harvesting priority to a more random harvest which expands the age profile. The timber supply in the western supply blocks tends to be more sensitive to changes in merchantability limits and to increases in the site index of old stands.

The base case harvest forecast is only one possible harvest forecast for the Williams Lake TSA given the flexibility provided by younger minimum harvestable ages and the increase in the size of the timber harvesting land base since the previous Timber Supply Review analysis. For example, it is possible to avoid the sharp reduction from the initial level shown in the base case, which corresponds to the end of salvage harvesting. In one alternative forecast, the base case initial level is maintained for 10 years followed by declines of about nine per cent per decade, reaching medium-term harvest level of 2.7 million cubic metres by decade five. This forecast would allow a less abrupt transition to the medium term than projected in the base case, but would be far more sensitive to changes in current management assumptions as existing natural stand volume would be allocated for harvest at a faster rate than in the base case.

Alternatively, an even-flow harvest of 3.05 million cubic metres could also be achieved. However, a higher medium-term harvest involves both more rapid harvest of existing natural stands and an earlier increase in the harvesting of managed stands than in the base case, with the result that total growing stock declines below the base case level, and the base case long-term level of 3.25 million cubic metres per year cannot be achieved.

The socio-economic analysis for the Williams Lake TSA indicates that the current AAC of 3.807 million cubic metres can support an estimated 3,070 person-years of direct employment and 4,106 person-years of indirect and induced employment across the province.

The base case harvest forecast for the next five years is 3.765 million cubic metres per year, which is 42 000 cubic metres, or 1.1% less than the current AAC. From year six onwards, the base case harvest forecast is 2.92 million cubic metres per year, a decline of about 23% from the current AAC.

If fully harvested and utilized, the volume in the base case harvest forecast in the first five years would generate an estimated $103.28 million in provincial government revenues per year. From year six onwards, the base case harvest forecast would generate an estimated $80.09 million per year.

If, as expected, the remaining inventory of beetle damaged timber in the TSA is harvested within the next five years, all timber harvests beginning in year six would be charged the full stumpage rate. In this situation, provincial government revenues projected for the medium term will increase from $80.09 million per year to $94.80 million per year.

# Table of Contents

PREFACE .......... III

EXECUTIVE SUMMARY .......... IV

INTRODUCTION .......... 1

1 DESCRIPTION OF THE WILLIAMS LAKE TIMBER SUPPLY AREA .......... 3
  1.1 THE ENVIRONMENT .......... 6
  1.2 FIRST NATIONS .......... 10

2 INFORMATION PREPARATION FOR THE TIMBER SUPPLY ANALYSIS .......... 11
  2.1 LAND BASE INVENTORY .......... 11
  2.2 TIMBER GROWTH AND YIELD .......... 17
  2.3 MANAGEMENT PRACTICES .......... 19

3 TIMBER SUPPLY ANALYSIS METHODS .......... 22

4 RESULTS .......... 23
  4.1 BASE CASE HARVEST FORECAST .......... 23
  4.2 HARVESTING STATISTICS .......... 27
  4.3 AGE CLASS PROFILE OVER TIME .......... 33

5 TIMBER SUPPLY SENSITIVITY ANALYSES .......... 35
  5.1 ALTERNATIVE HARVEST FLOWS OVER TIME .......... 36
  5.2 ANALYSES WITH EXPECTED OR NEGLIGIBLE IMPACTS .......... 38
  5.3 UNCERTAINTY IN THE MINIMUM HARVESTABLE AGE .......... 40
    5.3.1 Effect of minimum harvestable ages based on regional harvest age guidelines .......... 40
    5.3.2 Increase minimum harvestable age by 40 years .......... 41
  5.4 UNCERTAINTY IN THE MAXIMUM ALLOWABLE DISTURBANCE IN MULTIPLE USE AREAS .......... 42
  5.5 UNCERTAINTY IN THE ALLOWABLE DISTURBANCE IN PARTIAL RETENTION VISUAL MANAGEMENT AREAS .......... 43
  5.6 UNCERTAINTY IN SALVAGE OPERATIONS AND NATURAL REGENERATION OF LOW VOLUME MOUNTAIN PINE BEETLE (MPB) ATTACKED STANDS .......... 44
  5.7 UNCERTAINTY ABOUT DISTURBANCE IN STANDS OUTSIDE THE TIMBER HARVESTING LAND BASE .......... 45
  5.8 UNCERTAINTY IN THE SITE INDEX ASSIGNED TO STANDS ABOVE 140 YEARS OF AGE .......... 47
  5.9 UNCERTAINTY WITH THE HARVEST AGE PROFILE .......... 50
  5.10 UNCERTAINTY ABOUT THE MERCHANTABLE VOLUME THRESHOLD USED IN DEFINING THE TIMBER HARVESTING LAND BASE .......... 52
  5.11 DIFFERENCES IN FOREST COVER REQUIREMENT DESCRIPTION BETWEEN TSR 1 AND TSR 2 .......... 53
  5.12 COMBINED EFFECT OF UNCERTAINTY IN A NUMBER OF FACTORS .......... 55

6 SUMMARY AND CONCLUSIONS OF THE TIMBER SUPPLY ANALYSIS .......... 56

# Table of Contents

7 SOCIO-ECONOMIC ANALYSIS ..... 59
- 7.1 CURRENT SOCIO-ECONOMIC SETTING ..... 60
  - 7.1.1 Population and demographic trends ..... 60
- 7.1.2 ECONOMIC PROFILE ..... 61
- 7.2 DESCRIPTION OF THE FOREST INDUSTRY ..... 63
  - 7.2.1 Current allowable annual cut ..... 63
  - 7.2.2 Recent harvest history ..... 64
  - 7.2.3 Major licensees and processing facilities ..... 65
  - 7.2.4 Forestry sector employment and employment coefficients ..... 77
  - 7.2.5 Forestry sector employment income ..... 79
  - 7.2.6 Provincial government revenues ..... 80
- 7.3 IMPLICATIONS OF THE BASE CASE HARVEST FORECAST ..... 81
  - 7.3.1 Employment and employment income impacts within the Williams Lake TSA ..... 81
  - 7.3.2 Employment and employment income impacts in the province ..... 81
  - 7.3.3 Provincial government revenues ..... 82
  - 7.3.4 Community impacts ..... 83
  - 7.3.5 Log supply requirements of timber processing facilities in the Williams Lake TSA ..... 83
  - 7.3.6 Regional timber supply issues ..... 83
- 7.4 SUMMARY ..... 85

8 REFERENCES ..... 86

9 GLOSSARY ..... 87

APPENDIX A DESCRIPTION OF DATA INPUTS AND ASSUMPTIONS FOR THE TIMBER SUPPLY ANALYSIS ..... 93

INTRODUCTION ..... 94

A.1 INVENTORY INFORMATION ..... 95

A.2 ZONE AND ANALYSIS UNIT DEFINITION ..... 96

A.3 DEFINITION OF THE TIMBER HARVESTING LAND BASE ..... 100

A.4 FOREST MANAGEMENT ASSUMPTIONS ..... 110

A.5 VOLUME ESTIMATES ..... 135

APPENDIX B SOCIO-ECONOMIC ANALYSIS BACKGROUND INFORMATION ..... 159

B.1 LIMITATIONS OF ECONOMIC ANALYSIS ..... 160

B.2 ECONOMIC IMPACT ANALYSIS METHODOLOGY ..... 161

# Table of Contents

## Tables

TABLE 1. SPECIES AT RISK AS LISTED UNDER THE FOREST PRACTICES CODE IN THE CHILCOTIN FOREST DISTRICT ........ 7
TABLE 2. SPECIES AT RISK UNDER THE FOREST PRACTICES CODE IN THE WILLIAMS LAKE FOREST DISTRICT ........ 8
TABLE 3. SPECIES AT RISK UNDER THE FOREST PRACTICES CODE IN THE HORSEFLY FOREST DISTRICT ........ 9
TABLE 4. TIMBER HARVESTING LAND BASE FOR THE WILLIAMS LAKE TSA ........ 13
TABLE 5. SHORT-TERM HARVEST IN THE BASE CASE HARVEST FORECAST — WILLIAMS LAKE TSA, 2001 ........ 23
TABLE 6. SENSITIVITY ANALYSES WITH EXPECTED OR NEGLIGIBLE IMPACTS — WILLIAMS LAKE TSA, 2001 ........ 39
TABLE 7. AVERAGE AREA-WEIGHTED CHANGE IN SITE INDEX FOR STANDS OVER 140 YEARS OF AGE — WILLIAMS LAKE TSA, 2001 ........ 48
TABLE 8. FOREST COVER REQUIREMENTS BASED ON TSR 1, WILLIAMS LAKE TSA, 2001 ........ 53
TABLE 9. SUMMARY INFORMATION FROM THE TIMBER SUPPLY SENSITIVITY ANALYSES ........ 57
TABLE 10. POPULATION STATISTICS — WILLIAMS LAKE TSA ........ 60
TABLE 11. AVERAGE WEEKLY EARNINGS AND EMPLOYMENT MULTIPLIERS — WILLIAMS LAKE TSA ........ 62
TABLE 12. ALLOWABLE ANNUAL CUT APPORTIONMENT — WILLIAMS LAKE TSA, 1996 ........ 63
TABLE 13. AAC AND VOLUME BILLED, BY LICENCE TYPE — WILLIAMS LAKE TSA, 1996-2000 ........ 64
TABLE 14. AINSWORTH'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 65
TABLE 15. DAGISH'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 66
TABLE 16. JACKPINE'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 67
TABLE 17. LIGNUM'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 68
TABLE 18. RIVERSIDE'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 69
TABLE 19. TSI DEL'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 70
TABLE 20. TSILHQOT'IN'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 71
TABLE 21. WELDWOOD'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 72
TABLE 22. WEST FRASER'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 73
TABLE 23. YUN KA'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 74
TABLE 24. SBFEP'S HARVEST AND DIRECT EMPLOYMENT STATISTICS ........ 75
TABLE 25. TIMBER PROCESSING FACILITIES AND ESTIMATED ANNUAL CAPACITIES — WILLIAMS LAKE TSA, 2000 ........ 76
TABLE 26. FORESTRY SECTOR EMPLOYMENT AND EMPLOYMENT COEFFICIENTS — WILLIAMS LAKE TSA ........ 78
TABLE 27. ESTIMATE OF FORESTRY SECTOR PROVINCIAL EMPLOYMENT INCOME — WILLIAMS LAKE TSA ........ 79
TABLE 28. ESTIMATE OF AVERAGE ANNUAL PROVINCIAL REVENUES, 1998–2000 — WILLIAMS LAKE TSA ........ 80
TABLE 29. COMPARISON OF ESTIMATED PROVINCIAL REVENUES — BEETLE DAMAGED VERSUS NON-DAMAGED TIMBER ........ 82
TABLE 30. SOCIO-ECONOMIC IMPACTS OF WILLIAMS LAKE TSA BASE CASE HARVEST FORECAST ........ 84

# Table of Contents

## Tables (continued)

TABLE A-1. VOLUME ADJUSTMENT FACTORS FOR STANDS SIXTY YEARS OF AGE AND OLDER ........ 95
TABLE A-2. DEFINITION OF MANAGEMENT OBJECTIVES ........ 96
TABLE A-3. DEFINITION OF ANALYSIS UNITS ........ 98
TABLE A-4. PULPWOOD AGREEMENT 16 ANALYSIS UNIT DEFINITION ........ 99
TABLE A-5. OWNERSHIP CATEGORIES THAT DO NOT CONTRIBUTE TO THE TIMBER HARVESTING LAND BASE OR OTHER FOREST MANAGEMENT OBJECTIVES IN THE WILLIAMS LAKE TSA ........ 100
TABLE A-6. OWNERSHIP CATEGORIES THAT ARE EXCLUDED FROM THE TIMBER HARVESTING LAND BASE BUT CONTRIBUTE TO SOME FOREST MANAGEMENT OBJECTIVES ........ 101
TABLE A-7. OWNERSHIP CATEGORIES THAT ARE INCLUDED IN THE TIMBER HARVESTING LAND BASE ........ 101
TABLE A-8. DESCRIPTION OF ENVIRONMENTALLY SENSITIVE AREAS ........ 102
TABLE A-9. STEEP/UNSTABLE SLOPES ........ 102
TABLE A-10. ESTIMATES FOR EXISTING AND FUTURE ROADS, TRAILS, AND LANDINGS ........ 103
TABLE A-11. AREAS WITH LOW GROWTH POTENTIAL AND STAND TYPES THAT ARE NOT BEING HARVESTED ........ 104
TABLE A-12. STANDS NOT EXPECTED TO REACH MERCHANTABLE HEIGHT OR VOLUME ........ 104
TABLE A-13. INSECT ATTACKED PINE STAND MERCHANTABILITY CRITERIA. ........ 105
TABLE A-14. CONSIDERATIONS FOR CARIBOU HABITAT ........ 105
TABLE A-15. REDUCTIONS TO REFLECT RIPARIAN MANAGEMENT AREAS ........ 106
TABLE A-16. FOREST DISTRICT WILDLIFE TREE PATCH (WTP) STATISTICS BASED ON A RANDOM SAMPLE OF CUTTING PERMITS ........ 107
TABLE A-17. REDUCTIONS TO REFLECT WILDLIFE TREE PATCH AREAS ........ 107
TABLE A-18. CURRENT DISTRICT WILDLIFE TREE PATCH TARGETS (%) AND BIODIVERSITY EMPHASIS BY LANDSCAPE UNIT ........ 108
TABLE A-19. UTILIZATION LEVELS ........ 110
TABLE A-20. MINIMUM HARVEST CRITERIA ........ 111
TABLE A-21. REGENERATION KEY FOR ANALYSIS UNITS ........ 111
TABLE A-22. MINIMUM HARVESTABLE AGE ........ 112
TABLE A-23. VOLUME EXCLUSIONS FOR MIXED SPECIES TYPES ........ 116
TABLE A-24. VOLUME EXCLUSIONS FOR FOREST INVENTORY OPERATIONAL DISCREPANCY TYPES ........ 117
TABLE A-25. HARVESTING AND SILVICULTURAL ASSUMPTIONS FOR MOUNTAIN PINE BEETLE (MPB) ATTACKED STANDS ........ 118
TABLE A-26. ASSIGNING INSECT ATTACK LEVELS TO UNCLASSIFIED MOUNTAIN PINE BEETLE ATTACKED STANDS ........ 119
TABLE A-27. PARTIAL HARVEST SILVICULTURAL SYSTEM MANAGEMENT GUIDELINES ........ 120
TABLE A-28. SILVICULTURE AND HARVESTING REGIMES FOR PARTIAL HARVEST SYSTEMS ........ 121
TABLE A-29. HARVEST DEFERRALS BY RISK CATEGORY FOR MULE DEER WINTER RANGE ........ 122
TABLE A-30. REGENERATION ASSUMPTIONS BY ANALYSIS UNIT ........ 123
TABLE A-31. COMPARING LOGGING HISTORY AGE FOR STANDS WITH A PROJECTED INVENTORY AGE LESS THAN 21 YEARS ........ 126
TABLE A-32. FOREST COVER REQUIREMENTS FOR MULTIPLE USE AREAS WITHIN EACH DRAFT LANDSCAPE UNIT ........ 127
TABLE A-33. FOREST COVER REQUIREMENTS FOR VISUAL RESOURCE MANAGEMENT WITHIN EACH DRAFT LANDSCAPE UNIT ........ 128
TABLE A-34. FOREST COVER REQUIREMENTS FOR CARIBOU HABITAT WITHIN EACH DRAFT LANDSCAPE UNIT ........ 128

# Table of Contents

## Tables (continued)

TABLE A-35. FOREST COVER REQUIREMENTS WITHIN EACH MULE DEER WINTER RANGE ........ 129

TABLE A-36. MINIMUM PERCENTAGE REQUIREMENTS FOR MATURE AND OLD SERAL FOREST WITHIN EACH DRAFT LANDSCAPE UNIT ........ 130

TABLE A-37. BEC VARIANT RE-ASSIGNMENTS BY LANDSCAPE UNIT — FOR MODELLING PURPOSES ONLY ........ 131

TABLE A-38. UNSALVAGED LOSSES ........ 134

TABLE A-39. TSA LEVEL VOLUME LOSSES DUE TO MOUNTAIN PINE BEETLE ON PINE STANDS ........ 134

TABLE A-40. VOLUME ESTIMATES FOR EXISTING NATURAL STANDS (CUBIC METRES/HECTARE) ........ 135

TABLE A-41. VOLUME ESTIMATES FOR MANAGED STANDS (CUBIC METRES/HECTARE) ........ 141

TABLE A-42. VOLUME ESTIMATES FOR PARTIALLY HARVESTED STANDS (CUBIC METRES/HECTARE) ........ 155

TABLE B-1. EMPLOYMENT MULTIPLIERS — WILLIAMS LAKE TSA ........ 163

TABLE B-2. ESTIMATES OF PROVINCIAL GOVERNMENT REVENUES — WILLIAMS LAKE TSA ........ 165

# Table of Contents

## Figures

FIGURE 1. MAP OF THE WILLIAMS LAKE TIMBER SUPPLY AREA, CARIBOO FOREST REGION. .......... 5
FIGURE 2. AREA BY DOMINANT TREE SPECIES AND HARVEST REGIME — WILLIAMS LAKE TSA CURRENT TIMBER HARVESTING LAND BASE, 2001. .......... 15
FIGURE 3. CURRENT AGE CLASS DISTRIBUTION — WILLIAMS LAKE TSA FORESTED LAND BASE, 2001. .......... 16
FIGURE 4. AREA BY AGE RANGE BY SILVICULTURAL DESCRIPTION — WILLIAMS LAKE TSA TIMBER HARVESTING LAND BASE, 2001. .......... 18
FIGURE 5. TIMBER HARVESTING LAND BASE BY RESOURCE EMPHASIS — WILLIAMS LAKE TSA TIMBER HARVESTING LAND BASE, 2001 .......... 20
FIGURE 6. FORESTED AREA BY BIOGEOCLIMATIC CLASSIFICATION — WILLIAMS LAKE TSA, 2001. .......... 21
FIGURE 7. BASE CASE HARVEST FORECAST FOR THE WILLIAMS LAKE TSA, 2001. .......... 24
FIGURE 8. TRANSITION FROM HARVESTING EXISTING NATURAL STANDS TO MANAGED FOREST — WILLIAMS LAKE TSA, 2001. .......... 25
FIGURE 9. TOTAL GROWING STOCK THROUGH TIME — WILLIAMS LAKE TSA, 2001. .......... 26
FIGURE 10. HARVEST CONTRIBUTION BY FOREST DISTRICT — WILLIAMS LAKE TSA, 2001. .......... 27
FIGURE 11. HARVEST CONTRIBUTIONS OF THE ANAHIM SUPPLY BLOCK (SB A) AND PA 16 — WILLIAMS LAKE TSA, 2001. .......... 28
FIGURE 12. HARVEST CONTRIBUTION FROM THE INNOVATIVE FOREST PRACTICES AGREEMENT (IFPA) AREA — WILLIAMS LAKE TSA, 2001. .......... 29
FIGURE 13. AVERAGE VOLUME PER HECTARE HARVESTED — WILLIAMS LAKE TSA, 2001. .......... 30
FIGURE 14. ANNUAL AREA HARVESTED BY FOREST DISTRICT — WILLIAMS LAKE TSA, 2001. .......... 31
FIGURE 15. AVERAGE HARVEST AGE — WILLIAMS LAKE TSA, 2001. .......... 32
FIGURE 16. AGE PROFILE THROUGH TIME — WILLIAMS LAKE TSA, 2001 .......... 34
FIGURE 17. EVEN-FLOW HARVEST FORECAST AFTER SALVAGE HARVEST TERMINATED — WILLIAMS LAKE TSA, 2001. .......... 36
FIGURE 18. MAXIMUM LONG-TERM PRODUCTIVITY FROM CURRENT MANAGEMENT — WILLIAMS LAKE TSA, 2001 .......... 37
FIGURE 19. IMPLICATIONS OF USING A MINIMUM HARVESTABLE AGE BASED ON REGIONAL HARVEST AGE GUIDELINES — WILLIAMS LAKE TSA, 2001. .......... 40
FIGURE 20. IMPLICATIONS OF INCREASING MINIMUM HARVESTABLE AGES BY 40 YEARS — WILLIAMS LAKE TSA, 2001. .......... 41
FIGURE 21. IMPLICATIONS OF REDUCING THE MAXIMUM ALLOWABLE DISTURBANCE IN MULTIPLE USE AREAS TO 18% — WILLIAMS LAKE TSA, 2001. .......... 42
FIGURE 22. IMPLICATIONS OF REDUCING THE MAXIMUM ALLOWABLE DISTURBANCE IN PARTIAL RETENTION AREAS TO 6% — WILLIAMS LAKE TSA, 2001. .......... 43

## Figures (continued)

FIGURE 23. IMPLICATIONS OF ELIMINATING SALVAGE HARVEST AND NATURAL REGENERATION ASSUMPTIONS IN MOUNTAIN PINE BEETLE (MPB) ATTACKED PINE STANDS — WILLIAMS LAKE TSA, 2001. ....44
FIGURE 24. IMPLICATIONS OF STAND REPLACING EVENTS OUTSIDE THE TIMBER HARVESTING LAND BASE ONCE STANDS REACH 250 YEARS OF AGE — WILLIAMS LAKE TSA, 2001. ....45
FIGURE 25. COMPARISON OF AGE CLASS DISTRIBUTIONS IN 150 YEARS WITH AND WITHOUT (BASE CASE) DISTURBANCE OUTSIDE OF TIMBER HARVESTING LAND BASE — WILLIAMS LAKE TSA, 2001. ....46
FIGURE 26. IMPLICATIONS OF SITE INDEX ADJUSTMENTS FOR STANDS ABOVE 140 YEARS OF AGE AND MEETING THE REQUIREMENTS BASED ON THE REGIONAL PAIRED PLOT ADJUSTMENT APPLICATION GUIDELINES — WILLIAMS LAKE TSA, 2001. ....49
FIGURE 27. IMPLICATIONS OF A RANDOMIZED HARVEST WITH A PRIORITY TO STANDS ABOVE THE AGE OF MAXIMUM AVERAGE GROWTH THEN STANDS ABOVE 100 YEARS OF AGE — WILLIAMS LAKE TSA, 2001. ....51
FIGURE 28. IMPLICATIONS OF RAISING THE VOLUME CUT-OFF FOR MINIMUM MERCHANTABILITY TO 100 CUBIC METRES PER HECTARE –– WILLIAMS LAKE TSA, 2001. ....52
FIGURE 29. SIMPLIFIED REPRESENTATION OF TSR 1 FOREST COVER REQUIREMENTS — WILLIAMS LAKE TSA, 2001. ....54
FIGURE 30. IMPLICATIONS OF THE COMBINED INFLUENCE OF A SET OF FACTORS — WILLIAMS LAKE TSA, 2001. ....55
FIGURE 31. ESTIMATES OF EMPLOYMENT BY SECTOR — WILLIAMS LAKE TSA, 1996. ....61
FIGURE A-1. EVALUATION CRITERIA FOR MOUNTAIN PINE BEETLE ATTACKED STANDS IN THE CROWN PRODUCTIVE — WILLIAMS LAKE TSA, 2001. ....117

# Introduction

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Timber supply* is the quantity of timber available for harvest over time. Timber supply is dynamic, not only because trees naturally grow and die, but also because conditions that affect tree growth, and the social and economic factors that affect the availability of trees for harvest, change through time.

Assessing the timber supply involves considering physical, biological, social and economic factors for all forest resource values, not just for timber. Physical factors include the land features of the area under study as well as the physical characteristics of living organisms, especially trees. Biological factors include the growth and development of living organisms. Economic factors include the financial profitability of conducting forest operations, and the broader community and social aspects of managing the forest resource.

All of these factors are linked: the financial profitability of harvest operations depends upon the terrain, as well as the physical characteristics of the trees to be harvested. Determining the physical characteristics of trees in the future requires knowledge of their growth pattern. Decisions about whether a stand is available for harvest often depend on how its harvest could affect other forest values, such as wildlife or recreation.

These factors are also subject to both uncertainty and different points of view. Financial profitability may change as world timber markets change. Unforeseen losses due to fire or pest infestations will alter the amount and value of timber. The appropriate balance of timber and non-timber values in a forest is an ongoing subject of debate, and is complicated by changes in social objectives over time.

Thus, before an estimate of timber supply is interpreted, the set of physical, biological and socio-economic conditions on which it is based, and which define current forest management — as well as the uncertainties affecting these conditions — must first be understood.

Timber supply analysis is the process of assessing and predicting the current and future timber supply for a management unit (a geographic area). For a timber supply area (TSA)*, the timber supply analysis forms part of the information used by the chief forester of British Columbia in determining an allowable annual cut (AAC)*.

Timber supply projections made for TSAs look far into the future — 250 years or more. However, because of the uncertainty surrounding the information and because forest management objectives change through time, these projections should not be viewed as static prescriptions that remain in place for that length of time. They remain relevant only as long as the information upon which they are based remains relevant. Thus, it is important that re-analysis occurs regularly, using new information and knowledge to update the timber supply picture. Indeed, the *Forest Act* requires that the timber supply for management units throughout British Columbia be reviewed regularly. This allows close monitoring of the timber supply and of the implications for the AAC stemming from changes in management practices and objectives.

**Throughout this document, an asterisk after a word or phrase indicates that it is defined in a box at the foot of the page, as well as in the glossary.*

***Timber supply***
*The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.*
***Timber supply area (TSA)***
*An integrated resource management unit established in accordance with* Section 7 *of the* Forest Act.

***Allowable annual cut (AAC)***
*The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood per year.*

# Introduction

Timber supply analysis involves three main steps. The first is collecting and preparing information and data. The British Columbia Forest Service forest inventory* plays a major role in this. The second step is using this data along with a timber supply computer model or models* to make projections or estimates of possible harvest levels over time. These projections are made using different sets of assumed values or conditions for the factors discussed above. The third step is interpreting and reporting results.

Sections 1 through 6 of this report describe the timber supply analysis for the Williams Lake TSA. Following a brief description of the area in Section 1, Section 2 provides a discussion of data preparation and formulation of assumptions, and Section 3 outlines the timber supply analysis methodology. Timber supply analysis results, including an assessment of the critical timber management issues, are presented in Section 4. Section 5 examines the sensitivity of the results to uncertainties in the data and assumptions used, and is followed by a summary and conclusions in Section 6. Appendix A contains further details about the data and assumptions used in the timber supply analysis.

As part of the timber supply review (TSR), information is gathered on the short- and long-term implications of alternative harvest levels, and the capabilities and requirements of existing and proposed processing facilities. Section 7 of this report describes the socio-economic analysis, which provides the chief forester with some of the information necessary for these considerations. The socio-economic analysis also provides information for the local community to better understand the potential magnitude of impacts associated with any proposed harvest level changes.

Appendix B contains background information and some of the limitations of the socio-economic data.

The socio-economic analysis considers the current and projected levels of forestry activity associated with the Williams Lake TSA within the context of regional timber supplies and production capacity. It does this by examining the profile of the region and the local forest industry; and by undertaking a socio-economic analysis using the harvest forecasts* as projected in the base case.

The socio-economic analysis includes an estimate of the employment and income impacts associated with timber supply analysis projections by three main sectors: harvesting and woodlands-related activities, processing, and silviculture. Employment is measured in terms of person-years*. Employment income is calculated using average industry income estimates.

***Forest inventory***
*An assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of other forest values such as recreation and visual quality.*

***Model***
*An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities.*

# 1 Description of the Williams Lake Timber Supply Area

The Williams Lake Timber Supply Area (TSA), covering approximately 4.9 million hectares, is situated in the central interior of the province and is one of three TSAs in the Cariboo Forest Region. The TSA is bounded by the Quesnel TSA to the north, Wells Gray Park and Mitchell-Niagara Park to the east, the 100 Mile House and Lillooet TSAs to the south, and Tweedsmuir Provincial Park, Kingcome TSA and Sunshine Coast TSA to the west. The Williams Lake TSA includes three forest districts, and is administered by the Chilcotin Forest District office in Alexis Creek, the Williams Lake Forest District office in Williams Lake, and the Horsefly Forest District office in Horsefly.

According to the 1996 census, the population of the Williams Lake TSA was 27,260, an increase of about 5% from 1991. The major population centre is the City of Williams Lake, where about 40% of the TSA's population resides. Many other small communities are dispersed throughout the TSA, including Alexis Creek, Riske Creek, Big Creek, Tatla Lake, Nimpo Lake, Anahim Lake, 150 Mile House, Big Lake, Horsefly, Likely and McLeese Lake. As well, there are ten First Nations communities in the TSA.

The Williams Lake TSA includes three general landscape types. The Chilcotin Plateau, west of the Fraser River, is characterized by a drier climate with extensive lodgepole pine forests and some Douglas-fir, and is bounded on the west by the Coast Mountains. The central portion of the TSA, both east and west of the Fraser River, has mixed species forests, primarily leading in Douglas-fir and lodgepole pine, interspersed with significant open range lands. To the east of the Fraser River, the rolling plateau gently increases in elevation to meet the Cariboo Mountains and Quesnel Highland where forests of spruce, pine, western redcedar, western hemlock and subalpine fir predominate.

Within the land base currently considered available for timber harvesting, lodgepole pine dominates forests covering about 67% of the area, followed by Douglas-fir 18%, spruce-subalpine fir 9%, a mix of stand types in caribou habitat 5%, cedar-hemlock 2% and deciduous* 1%. A relatively high proportion of younger pine stands have developed following major fire disturbances 20 or more years ago. The youngest stands in the TSA result from forest regeneration following logging and are predominantly composed of lodgepole pine, Douglas-fir and spruce. Some relatively old stands, mainly comprised of spruce and subalpine fir, are found in higher elevation areas with higher precipitation.

About 64% of the total Williams Lake TSA land base is considered Crown forest land managed by the British Columbia Forest Service (approximately 3.15 million hectares). Currently about 67% of the Crown forest land is considered available for timber harvesting (2.1 million hectares, or about 43% of the total TSA land base).

***Deciduous***
*Deciduous trees shed their leaves annually and commonly have broad-leaves.*

# 1 Description of the Williams Lake Timber Supply Area

In January 1995, the chief forester established an allowable annual cut (AAC) in the Williams Lake TSA of 3.8 million cubic metres, a decrease of 168 000 cubic metres from the 1992 determination. The AAC was reconfirmed in the *Rationale for reconsideration of Allowable Annual Cut determination*, March 31, 1997. The AAC is apportioned by the Minister of Forests to various licences. AACs and areas of issued woodlot licences* are not included in this timber supply review since AAC determination and administration for these tenures is separate from the TSA.

Significant changes in forest management legislation, policy and practices have occurred since the last timber supply review was completed. These include:

- implementation of the *Forest Practices Code (FPC)**;
- management direction from the Cariboo-Chilcotin Land Use Plan (CCLUP);
- updated visual classes and operability* lines; and
- delineation of draft landscape units (LU)* and assignment of biodiversity* emphasis (BE).

The Cariboo-Chilcotin Land Use Plan was approved by government in October 1994 and subsequently declared a Higher Level Plan (HLP)* on January 31, 1996, under the *Forest Practices Code of British Columbia Act*. With the advice of the Regional Resource Board, the Interagency Management Committee developed additional information regarding implementation of the land use plan. The Higher Level Plan was varied on June 22, 1999, and the *Cariboo-Chilcotin Land Use Plan — Integration Report* was given official government policy status. Approval of the plan included implementation of 11 new protected areas*, which are removed from the timber harvesting land base* for this analysis. The timber supply review considers practices that are currently being implemented toward achieving the objectives of the land use plan.

Numerous natural resources are associated with the forest land base in the Williams Lake TSA, including forest products (timber and non-timber), minerals, wildlife habitat, and recreation and tourism opportunities. Extensive grassland and forested areas (including recently harvested areas) provide forage vegetation for both livestock and wildlife. Parks, recreation sites and trails, plus roaded and non-roaded areas provide opportunities for numerous outdoor activities, including hiking, mountain-biking, fishing, hunting, camping, canoeing, guided horse tours, snowmobiling and cross-country skiing.

***Woodlot licence***
*An agreement entered into under the* Forest Act. *It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis.*
***Forest Practices Code***
*Legislation, standards and guidebooks that govern forest practices and planning, with a focus on ensuring management for all forest values.*
***Operability***
*Classification of an area considered available for timber harvesting. Operability is determined based on terrain characteristics and timber quality and quantity in the area.*

***Landscape unit***
*A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives.*
***Biodiversity (biological diversity)***
*The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.*
***Higher level plans***
*Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area.*
***Protected area***
*A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations).*
***Timber harvesting land base***
*Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology.*

# 1 Description of the Williams Lake Timber Supply Area

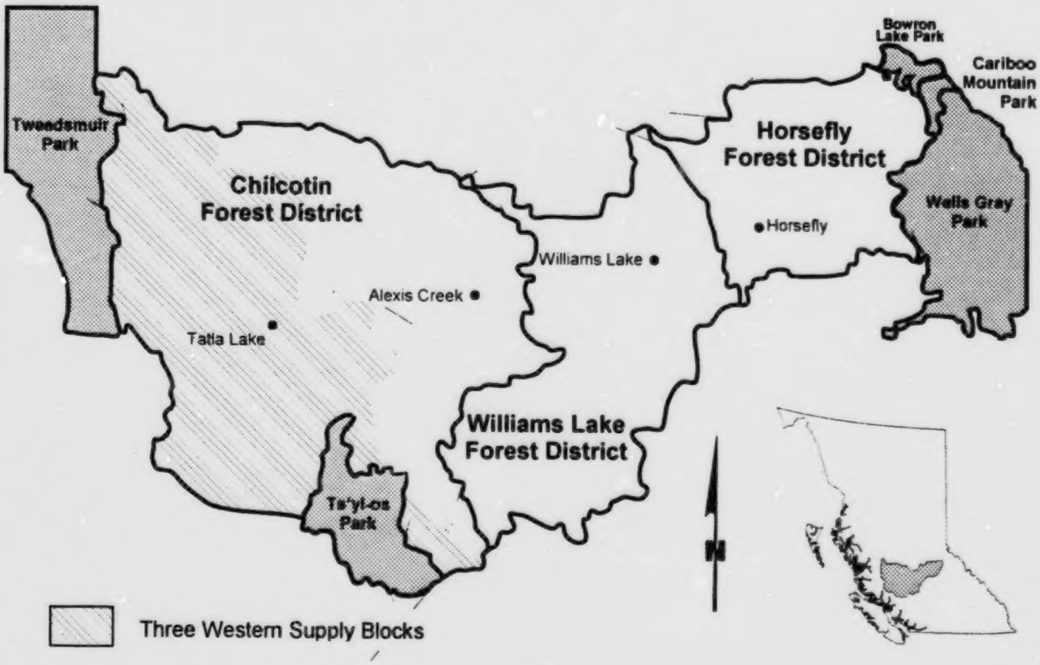
Tweedsmuir Park
Chilcotin Forest District
Alexis Creek
Tatla Lake
Williams Lake
Ts'yl-os Park
Williams Lake Forest District
Horsefly Forest District
Horsefly
Bowron Lake Park
Cariboo Mountain Park
Wells Gray Park
N
Three Western Supply Blocks

*Figure 1. Map of the Williams Lake Timber Supply Area, Cariboo Forest Region.*

# 1 Description of the Williams Lake Timber Supply Area

## 1.1 The environment

The diversity of climate and vegetation in the Williams Lake TSA contributes to the high biodiversity in this TSA and is reflected in the presence of eight forested biogeoclimatic zones* in the TSA.

The Bunchgrass (BG) zone has a very limited presence, occurring at the lowest elevations of the Fraser and Chilcotin river valleys in the south-central part of the TSA. This zone is characterized by warm to hot, dry summers and moderately cool winters with relatively little snowfall. Grasslands predominate, as tree establishment is restricted to relatively cool and moist sites. Although not significant as a source of harvestable timber, the BG zone is important for agriculture, ranching and biodiversity. It also supports a wide range of wildlife, including many species that are of provincial or national significance because of their rarity or uniqueness.

The Interior Douglas-fir (IDF) zone dominates lower to middle elevations in the central and southeastern parts of the TSA, around the Chilcotin and Fraser rivers. The IDF zone has warm, dry summers and cool, dry winters, allowing a long growing season. Douglas-fir and lodgepole pine are the most common tree species, with spruce and trembling aspen also occurring. Forestry is a very important resource use in this zone, as is cattle grazing. Wildlife values are also high.

The Sub-Boreal Pine Spruce (SBPS) zone occurs primarily on the Chilcotin Plateau in the western part of the TSA, in the rainshadow of the Coast Mountains. This zone generally lies above the IDF and below the Montane Spruce zone. The climate is characterized by cold, dry winters and cool, dry summers. Tree growth is restricted by the cool, dry conditions during the short growing season. Nighttime frosts are common in all seasons. Lodgepole pine is by far the most abundant tree species, but white spruce and trembling aspen are also common.

The Montane Spruce (MS) zone occurs at middle elevations in the western part of the TSA, generally above the SBPS zone and below the Engelmann Spruce-Subalpine Fir zone. The MS zone has cold winters and moderately short, cool summers. The dominant tree species is lodgepole pine, while hybrid spruce and subalpine fir are often present in the understory. Spruce stands occur on moist lower slopes and riparian areas*.

The Interior Cedar-Hemlock (ICH) zone occurs at low to mid elevations in the Quesnel Highland in the eastern portion of the Williams Lake TSA. Cool, wet winters and warm, dry to moist summers characterize the ICH zone. It is the most productive forest zone for timber in the TSA and has the highest diversity of tree species. Common tree species are western redcedar, hybrid white spruce, western hemlock, subalpine fir, Douglas-fir, lodgepole pine, birch and various poplar species.

The Sub-Boreal Spruce (SBS) zone occurs in the central northern and eastern portions of the TSA, where the climate is drier and slightly cooler than the Interior Cedar-Hemlock zone. The SBS zone is characterized by cool, snowy winters and moderately warm, moist summers. Annual precipitation is moderate. Common tree species are hybrid white spruce, subalpine fir, lodgepole pine, trembling aspen, paper birch and Douglas-fir.

The Engelmann Spruce-Subalpine Fir (ESSF) zone is the uppermost forested zone. Growing seasons are cool and short, while winters are long and cold. In the Quesnel Highland/Cariboo Mountains, the ESSF has a relatively cold, moist and snowy continental climate and Engelmann spruce and subalpine fir are the dominant climax tree species. On the leeward side of the Coast Mountains, the ESSF is significantly drier and lodgepole pine forests are dominant. Whitebark pine is also common at upper elevations in the Coast Mountains.

The Alpine Tundra (AT) zone occurs above the ESSF zone, and its climate is cold, windy and snowy with a short, cool growing season. This zone is largely treeless and vegetation is dominated by shrubs, herbs, mosses and lichens. Much of the AT zone in the Coast Mountains has little vegetative cover.

***Biogeoclimatic zones***
*A large geographic area with broadly homogeneous climate and similar dominant tree species.*

***Riparian area***
*Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.*

# 1 Description of the Williams Lake Timber Supply Area

The diverse landscapes of the Williams Lake TSA provide a variety of wildlife habitats, including grasslands, lakes and wetlands, forested slopes, and alpine areas. Large mammals in the TSA include mule deer, moose, mountain goat, caribou, California bighorn sheep, cougars, black bears, grizzly bears, coyotes and wolves. Many smaller furbearers such as snowshoe hares, pine marten and squirrels are also common. The TSA has numerous rivers, lakes and streams that support many species of non-sport fish and sport fish such as sockeye and chinook salmon, steelhead, sturgeon, rainbow trout, kokanee and bull trout.

Under the *Forest Practices Code*, a process exists for identifying species at risk and designating wildlife habitat areas (WHA) with specific management practices. The wildlife species that have been declared Identified Wildlife in the ecosections of the Chilcotin, Williams Lake and Horsefly Forest Districts are presented in Tables 1, 2 and 3 respectively. The Chilcotin Plateau ecosection covers about 40% of the TSA.

*Table 1. Species at risk as listed under the Forest Practices Code in the Chilcotin Forest District*

| Common names of identified wildlife | Ecosection | | | | | | |
|---|---|---|---|---|---|---|---|
| | Northern Pacific Ranges | Central Chilcotin Ranges | West. Chilcotin Ranges | Chilcotin Plateau | Fraser River Basin | Nazko Upland | West. Chilcotin Upland |
| Bull trout | x | x | x | x | x | x | x |
| Rubber boa | | | | | x | | |
| American white pelican | | | | x | x | x | x |
| American bittern | | | | x | | x | |
| Northern goshawk atricapillus | x | x | x | x | x | x | x |
| Prairie falcon | | | | x | x | | |
| Sandhill crane | | | x | x | | x | x |
| Long-billed curlew | | | | x | x | | |
| Fisher | x | x | x | x | x | x | x |
| Grizzly bear | x | x | x | x | | x | x |
| Mountain goat | x | x | x | | | | x |
| Bighorn sheep canadensis | | x | | | | | x |

Source: *Managing Identified Wildlife: Procedures and Measures Volume 1*, February 1999.

*Table 2. Species at risk under the Forest Practices Code in the Williams Lake Forest District*

| **Common names of identified wildlife** | **Ecosection** | | | | | |
|---|---|---|---|---|---|---|
| | **Central Chilcotin Ranges** | **Cariboo Basin** | **Cariboo Plateau** | **Chilcotin Plateau** | **Fraser River Basin** | **Nazko Upland** |
| Bull trout | x | x | x | x | x | x |
| Rubber boa | | x | | x | x | |
| Gopher snake ssp. Deserticola | | | | | x | |
| Western grebe | | x | | | | |
| American white pelican | | x | | x | x | x |
| American bittern | | x | x | x | x | |
| Northern goshawk atricapillus | x | x | x | x | x | x |
| Prairie falcon | | x | x | x | x | |
| Sandhill crane | | x | x | x | x | x |
| Long-billed curlew | | x | | x | x | |
| Lewis's woodpecker | | | | | x | |
| Brewer's sparrow ssp. Breweri | | | | | x | |
| Bobolink | | x | x | | | |
| Fisher | x | x | x | x | x | x |
| Grizzly bear | x | | x | x | | x |
| Bighorn sheep ssp. Californiana | x | x | | x | x | |

Source: *Managing Identified Wildlife: Procedures and Measures, Volume 1*, February 1999.

*Table 3. Species at risk under the Forest Practices Code in the Horsefly Forest District*

| Common names of identified wildlife | Ecosection | | | |
|---|---|---|---|---|
| | Cariboo Plateau | Bowron Valley | Cariboo Mountains | Quesnel Highland |
| Bull trout | x | x | x | x |
| American bittern | x | x | | x |
| Northern goshawk atricapillus | x | x | x | x |
| Prairie falcon | x | | | |
| Sandhill crane | x | x | x | x |
| Bobolink | x | | | x |
| Fisher | x | x | x | x |
| Grizzly bear | x | x | x | x |
| Mountain goat | | | x | x |

Source: *Managing Identified Wildlife: Procedures and Measures, Volume 1*, February 1999.

Protection of water quality and quantity is an important management objective in this TSA. Significant demands are placed on water resources for domestic and agricultural purposes, as well as maintenance of fisheries values and aquatic ecosystems.

Current forest management practices follow the legislation set out by the *Forest Practices Code*. Consequently, the protection of many non-timber resources and values is in accordance with the *Code*. In addition, the Cariboo-Chilcotin Land Use Plan provides management direction for public forest lands in the Williams Lake TSA, as well as for wildlife habitat.

## 1.2 First Nations

Ten Secwepemc, Tsilhqot'in and Carrier bands have reserves and have claimed traditional territory within the Williams Lake TSA. These bands (with the exception of Esketemc which is independent of tribal council membership) are affiliated with the Northern Secwepemc te Qelmucw (Cariboo Tribal Council), the Carrier-Chilcotin Tribal Council, and the Tsilhqot'in National Government. As well, 12 other bands that do not have reserves in the TSA have asserted traditional territory within it; they are members of the Secwepemc, Tsilhqot'in, Carrier, Stl'atl'imx, Coast Salish and Kwakiutl Nations.

The Northern Secwepemc te Qelmucw (Cariboo Tribal Council) and Esketemc First Nation are both at stage 4 of the British Columbia Treaty Process (negotiating an Agreement-in-Principle).

The Canoe Creek, Soda Creek, Williams Lake, Canim Lake and Alkali Lake bands have conducted traditional use studies of their traditional territories. The Tsilhqot'in National Government is in the final year of a four-year traditional use study. In addition, archaeological overview assessments (AOA) have been completed for the TSA. These assessments define areas of archaeological potential and list all recorded archaeological sites. Numerous archaeological sites exist within the Williams Lake TSA and archaeological impact assessments (AIA) are normally undertaken if recommended by an archaeologist as part of forest development planning.

In general, First Nations in the Williams Lake TSA support sustainable forest management. All First Nations express concerns about harvesting impacts on their aboriginal interests, and about lack of aboriginal involvement in the forestry economic sector. The forest industry provides some employment to First Nations members in silviculture and harvesting. In addition, several bands hold timber tenures independently or in partnership with forest companies. However, all the bands desire a greater participation in the industry, through a larger allocation of the harvestable timber.

# 2 Information Preparation for the Timber Supply Analysis

The following sections provide an outline of the information used in the timber supply analysis. This information can be divided into three general categories: land base inventory; timber growth and yield; and management practices.

## 2.1 Land base inventory

Land base information used in this analysis came in the form of a computer file compiled in 1999 by the British Columbia Forest Service. This file contains information on the forest land in the Williams Lake TSA including the geographic location, area, nature of forest cover (such as presence or absence of trees; species, number and age of trees; and timber volume), environmental sensitivity, and occurrence of range burns or seismic activities. Stand characteristics such as tree height, stocking* and age have been projected to 1999. Also, the file has been updated to account for timber harvesting up to 1998.

The inventory file represents the land base for the entire TSA. It includes information on land that does not contain forest, and on areas where timber harvesting is not expected to occur. Examples are lands set aside for parks, areas needed to protect wildlife habitat, power line rights-of-way, highways, or town sites. A general description of these areas specific to the Williams Lake TSA is provided below.

Before assessing timber supply, the TSA is classified and specific areas (e.g., stand of trees) are assigned either to the timber harvesting land base, or to the non-contributing land base. There is no double-counting of area; for example, the area of a forest stand that falls within a park, and also has sensitive soils, is assigned only once to the non-contributing land base.

Identifying areas as not contributing to timber supply does not mean they are removed from the Williams Lake TSA. The British Columbia Forest Service still manages the entire area of the TSA (except for designated areas under the jurisdiction of other agencies) as a land unit that contributes a mix of timber and non-timber values. The timber supply is managed within an integrated resource* context, and the analysis described in this report is consistent with this philosophy.

In the Williams Lake TSA, the following types of areas were considered unavailable for the timber harvesting land base.

- not managed by the British Columbia Forest Service — these are non-Crown areas (such as private land and Federal reserves) and parks which are removed from the TSA. The forested portions of parks and ecological reserves contribute towards landscape-level biodiversity.
- woodlot licences (WLs) — AACs and management in woodlot licences are administered separately from the rest of the TSA. The areas in WLs issued since the last AAC determination, with AACs totalling about 23 600 cubic metres per year, have been excluded from the TSA timber harvesting land base.
- non-forested and non-productive forested areas, such as alpine areas, water bodies, swamps.

***Stocking***
*The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.*

***Integrated resource management (IRM)***
*The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making.*

- areas covered by non-commercial brush species.
- existing unclassified roads and trails in stands under sixty years of age — roads and trails in stands above sixty years of age are assumed to be accounted for through volume adjustment factors developed for the timber supply analysis based on field sampling.
- environmentally sensitive areas (ESA)* — areas with highly sensitive soils, likelihood of regeneration difficulties, avalanche hazard or hydrological concerns are considered unavailable for harvest.
- steep slopes — currently, slopes greater than 40% are not generally being harvested and have been removed from consideration for the timber harvesting land base.
- currently unharvested stand types — previously part of the "problem forest types (PFT)" category, these are stands in specified areas of the TSA that are not currently harvested. Other merchantability criteria such as site productivity, height and volume replace the broad "problem forest types" category used in previous timber supply analysis.
- sites with low productivity (less than 7 metres in height by 50 years of age rather than 'L' inventory site class).
- no-harvest areas in the caribou zone as assigned through the Cariboo-Chilcotin Land Use Plan (CCLUP).
- any recent parks that have not received an update in their ownership code.
- lake buffers — areas around class A and selected other unclassified lakes have been considered unavailable for timber harvesting.
- riparian reserve areas — areas adjacent to riparian and stream ecosystems that are not available for timber harvesting.
- not satisfactorily restocked (NSR) areas* (with the exception of those created as a result of logging) — these areas were created through natural disturbance (i.e., fires, windthrow) and may not be treated or evaluated for timber growing potential for many years.
- stands not expected to reach the minimum merchantable height by 160 years of age.
- stands not expected to reach the minimum merchantable volume by 160 years of age (with the exception of stands eligible for salvage harvest where the existing stand condition was compared with the salvage merchantability limits).
- areas expected to be retained for wildlife tree patches (WTP).

A more detailed description of these categories, including specific criteria for removal is located in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis." Table 4 summarizes the areas in each category, and shows the area of the timber harvesting land base. The column "Crown productive forest area by classification" provides the total area within the given category. For example, while a total of 111 363 hectares of Crown productive forest is on steep slopes, only 71 436 hectares were removed specifically due to steepness. The difference arises because one area can be in more than one classification (e.g., non-commercial brush, and ESA). The order listed in Table 4 is the sequence used when excluding areas from the timber harvesting land base. If the order were changed, the areas in the various categories would also change but the timber harvesting land base would remain the same.

***Environmentally sensitive areas***
*Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches.*

***Not satisfactorily restocked (NSR) areas***
*An area not covered by a sufficient number of well-spaced tree stems of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR.*

*Table 4. Timber harvesting land base for the Williams Lake TSA*

| Land classification | Productive forest area by classification (hectares) | Area (hectares) | Per cent (%) of total TSA area | Per cent (%) of productive Crown forest land |
|---|---|---|---|---|
| Total TSA area | | 4 904 558 | | |
| Land not managed by the British Columbia Forest Service | | 731 929 | | |
| Non-productive forest | | 1 026 803 | | |
| **Productive forest managed by the British Columbia Forest Service (Crown forest)** | | **3 145 826** | 64.1 | 100.0 |
| **Reductions to the Crown forest available for timber supply** | | | | |
| • Non-commercial brush | | 1 587 | 0.0 | 0.1 |
| • Existing unclassified roads and trails in stands under 60 years old | 14 801 | 14 801 | 0.3 | 0.5 |
| • Environmentally sensitive areas | 117 269 | 115 742 | 2.4 | 3.7 |
| • Steep slopes | 111 363 | 71 436 | 1.5 | 2.3 |
| • Currently unharvested stand types | 122 977 | 97 877 | 2.0 | 3.1 |
| • Sites with low productivity (< 7 m site index) | 248 135 | 207 689 | 4.2 | 6.6 |
| • Caribou no-harvest areas | 104 052 | 75 218 | 1.5 | 2.4 |
| • Recent park designations | 109 023 | 74 149 | 1.5 | 2.4 |
| • Lake buffers for Class A lakes | 2 150 | 1 726 | 0.0 | 0.1 |
| • Riparian reserves | | 50 054 | 1.0 | 1.6 |
| • Not satisfactorily restocked (NSR) areas (except those created through logging) | 15 451 | 10 314 | 0.2 | 0.3 |
| • Stands not expected to reach the minimum merchantable height by 160 years of age[a] | 160 952 | 9 996 | 0.2 | 0.3 |
| • Stands not expected to reach the minimum merchantable volume by 160 years of age[a] | 399 990 | 225 323 | 4.6 | 7.2 |
| • Wildlife tree patches (WTP) | | 93 663 | 1.9 | 3.0 |
| Total reductions | | 1 049 575 | 21.4 | 33.4 |
| **Current timber harvesting land base** | | **2 096 251** | 42.7 | 66.6 |
| Future additions: | | | | |
| • Beetle attacked stands expected to regenerate naturally and contribute to the timber harvesting land base | | 85 039 | 1.7 | 2.7 |
| Future reductions | | | | |
| • Future roads trails and landings | | 59 289 | 1.2 | 1.9 |
| **Future timber harvesting land base** | | **2 122 001** | 43.3 | 67.5 |

(a) Mountain pine beetle (MPB) attacked stands have been evaluated against their current condition for salvage harvest purposes since salvage is expected to cease in five years, and natural regeneration of these sites is expected to begin.

+1

# 2 Information Preparation for the Timber Supply Analysis

The current timber harvesting land base is approximately 430 000 hectares larger (26%) than that used in the last timber supply analysis report. This is due mostly to the use of merchantability limits to define stands that are unlikely to be harvested rather than broad forest type* descriptions (i.e. PFTs). It is important to note that while these stands were not in the timber harvesting land base in the last analysis, they were effectively brought into the operational timber harvesting land base in the AAC determination through a problem forest type partition* of 100 000 cubic metres per year, and a partition of 107 000 cubic metres per year from certain stand types in the Pulpwood Agreement (PA)* 16 area. Additional smaller increases in the timber harvesting land base since the last analysis can be attributed to lower initial losses due to existing roads and trails, and redefined no-harvest areas for caribou habitat. The deferral on the Chilko planning area has been eliminated with the creation of Ts'yl-os provincial park and the Taseko management zone. These increases have been slightly offset by larger exclusions for steep slopes, and for riparian areas and wildlife tree patches (WTP) under the *Forest Practices Code,* as well as a reduction in the total inventory volume due to volume adjustments based on inventory sampling.

***Forest type***
*The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples.*
***Partition***
*A portion of the AAC that is attributable to certain types of timber and/or terrain.*

***Pulpwood agreements***
*An agreement applying to a fixed geographic area that allows harvesting of timber below sawlog standards if mill residues suitable for the facility under the agreement are not available.*

Figure 2 shows the current composition of the timber harvesting land base by dominant species and management regime for each of the three forest districts found in the Williams Lake TSA. Stands mainly composed of lodgepole pine trees cover most of the timber harvesting land base (about 67%) however the species distribution changes across the TSA. For example, most of the Douglas-fir stands are located in the Williams Lake Forest District while most of the spruce-leading stands can be found in the Horsefly Forest District. Stands found within the caribou modified harvest area are managed by two partial harvest regimes with most of the area occurring in the Chilcotin Forest District. About 13% of the timber harvesting land base shows some level of impact by mountain pine beetle (MPB). About 24% of all pine stands in the IDF and SBPS BEC zones are still impacted by mountain pine beetle.

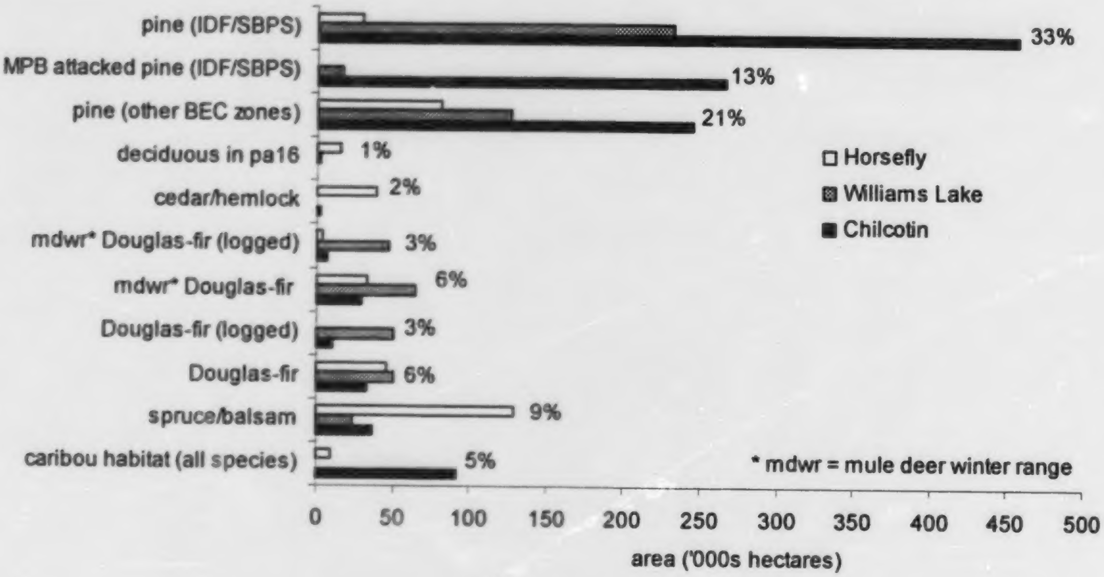

*Figure 2. Area by dominant tree species and harvest regime — Williams Lake TSA current timber harvesting land base, 2001.*

Figure 3 shows the current age class distribution of the productive forest used in the analysis. This includes the timber harvesting land base, forest outside the timber harvesting land base and timber harvesting land base deferred from harvest. Harvesting has been deferred in parts of the timber harvesting land base in the mule deer winter range (MDWR) to ensure that crown closure objectives defined for individual MDWRs can be recovered or sustained. In addition, partial harvest stands that are between harvest entries are included in the deferral category for descriptive purposes. Very few stands are currently above 250 years of age (4%) and about a third of the productive forest is above 140 years of age.

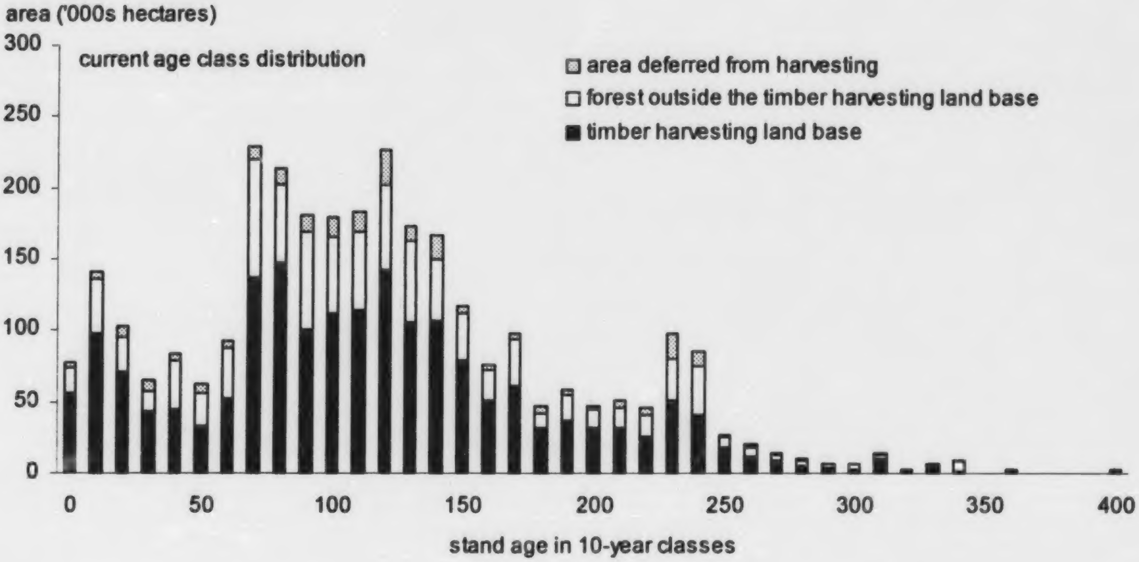

*Figure 3. Current age class distribution — Williams Lake TSA forested land base, 2001.*

## 2.2 Timber growth and yield

Timber growth and yield refers to the prediction of the growth and development of forest stands over time. Forest stands have many characteristics that change over time that could be the subject of growth and yield (for example, number of trees per area, tree diameter, tree height, species composition). Since timber supply analysis concentrates on timber volumes available over time, the most relevant measure for this analysis is volume per area (in British Columbia, cubic metres per hectare). An estimate of timber volume in a stand assumes a specific utilization level, or set of dimensions, that establish the minimum tree and log sizes that are removed from a site. Utilization levels used in estimating timber volumes specify minimum diameters both near the base and the top of a tree.

Based on the timber volume estimates* used in this analysis, the current timber inventory on the timber harvesting land base is approximately 238 million cubic metres (excluding wildlife trees (WTs)* retained within cutblocks*). About 186 million cubic metres, or 78% of the volume on the timber harvesting land base, are currently older than minimum harvestable age (MHA) and not deferred from harvest. The merchantable volume of forests currently deferred from harvest (stands either in MDWR deferrals or selection managed stands that are between harvest entries) is approximately 29 million cubic metres.

***Volume estimates (yield projections)***
*Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands.*

***Wildlife tree***
*A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife.*

***Cutblock***
*A specific area, with defined boundaries, authorized for harvest.*

Figure 4 shows broad classes that describe the current silvicultural condition or regime. Selection management* which makes up about 19% of the timber harvesting land base and includes areas in mule deer winter range, caribou habitat and Douglas-fir selection. The other 81% of the timber harvesting land base is expected to be clearcut harvested*. About 20% of the timber harvesting land base is above 140 years of age while 13% is assumed to be growing as managed forest (generally, younger than 34 years in the main TSA, and younger than 20 years in the western supply blocks). Almost half of the timber harvesting land base is not considered managed forest and is below 140 years of age.

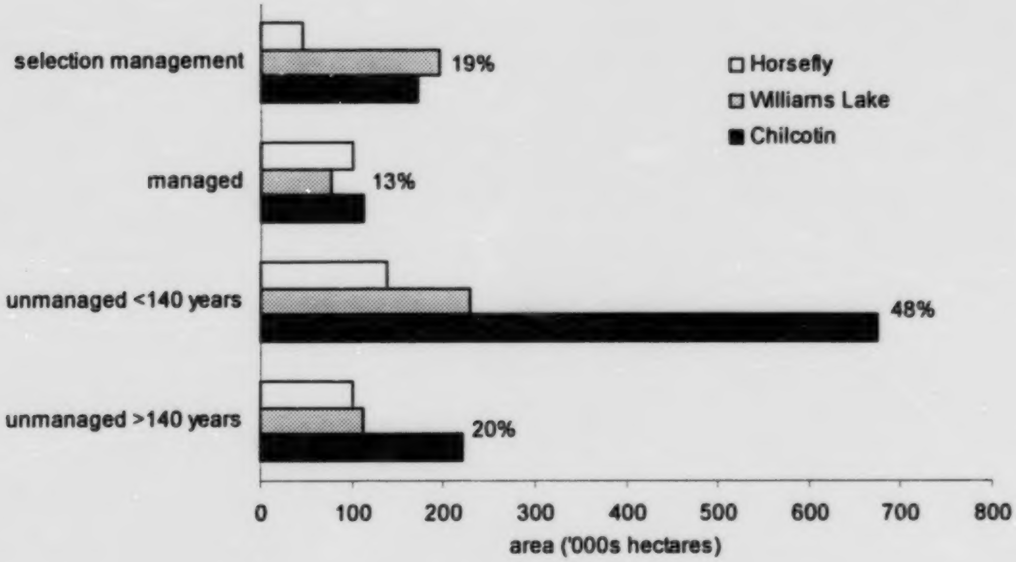

*Figure 4. Area by age range by silvicultural description — Williams Lake TSA timber harvesting land base, 2001.*

***Selection management***
*A silvicultural system used to maintain or create an uneven-aged forest by harvesting a limited number of trees of various sizes and ages over time. The time interval between harvests in such areas is fairly short (usually less than 30 years), and during these harvests either single scattered trees or small groups of trees are removed from across the entire area.*

***Clearcut harvesting***
*A harvesting method in which all trees are removed from an area of land in a single harvest. The harvested site is then regenerated to acceptable standards by appropriate means including planting and natural seeding. Note that retention of some live trees and snags for purposes of biodiversity now occurs on most clearcuts.*

## 2.3 Management practices

Timber supply depends on how the forest is managed for both timber and non-timber values. Therefore, levels of management activity must be defined for the timber supply analysis process. The *Forest Practices Code of British Columbia Act* and associated regulations, and the Cariboo-Chilcotin Land Use Plan (CCLUP), a higher level plan, guide forest management practices in the Williams Lake TSA. The focus of the timber supply review is to assess timber supply based on current management practices as implemented in plans for the area. Staff in the forest districts within the Williams Lake TSA provided descriptions for the following management practices:

- Silviculture practices — reforestation activities required to establish free-growing* stands of acceptable tree species. Most areas in the Williams Lake TSA are harvested using a clearcut harvesting system and restocked either by planting or through natural regeneration. Stands harvested using selection methods are assumed to regenerate naturally between harvesting entries.
- Incremental silviculture — where necessary, stands are spaced early in their development to ensure young trees are well distributed to maximize growth. Improved seed from seed orchards is used in stands planted with spruce stock to increase productivity.
- Forest health and unsalvaged losses* — unharvestable timber losses to fire, wind and insect damage are expected to average 53 500 cubic metres per year. A significant salvage program has been operating in the Williams Lake TSA since 1985 and the timber supply implications of the MPB attack on stands were represented explicitly in this analysis through the use of stand-level disturbance information. About eleven million cubic metres has been killed or damaged in existing natural stands (see Table A-39 "TSA level volume losses due to mountain pine beetle on pine stands" in Appendix A for a summary of pine volume loss). Some volume recovery will occur in addition to the yields provided in the analysis. That is, the yields in the analysis do not include any trees killed by the beetle; however, dead wood is often harvested during salvage operations.

***Free-growing***
*An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.*

***Unsalvaged losses***
*The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested.*

Figure 5 shows the composition of the timber harvesting land base by resource emphasis. Almost 74% of the timber harvesting land base in both the Horsefly and Chilcotin Forest Districts is in the multiple use resource management emphasis zone compared to 58% in the Williams Lake Forest District. Selection management is used for harvesting approximately 31% of the volume within the Williams Lake Forest District as seen by the significant amounts of Douglas-fir selection and mule deer winter range in Figure 5. Overlaps between mule deer winter range and other management emphasis represent stands that do not have at least 40% Douglas-fir content and are therefore assumed to be clearcut. Selection harvesting is used in some areas subject to a retention visual quality objective. In these areas, no specific forest cover requirements are applied since selection harvesting is expected to meet visual quality objectives. These areas were grouped with the mule deer winter range high crown closure objective analysis unit (AU)* since growth and yield in both types of areas is expected to be similar.

In most of these resource emphasis areas, management requirements are applied to ensure that recent disturbance is limited or sufficient forest cover is retained to achieve the specified objectives. The forest cover requirements for each emphasis area are described in Section A.4.11 of Appendix A.

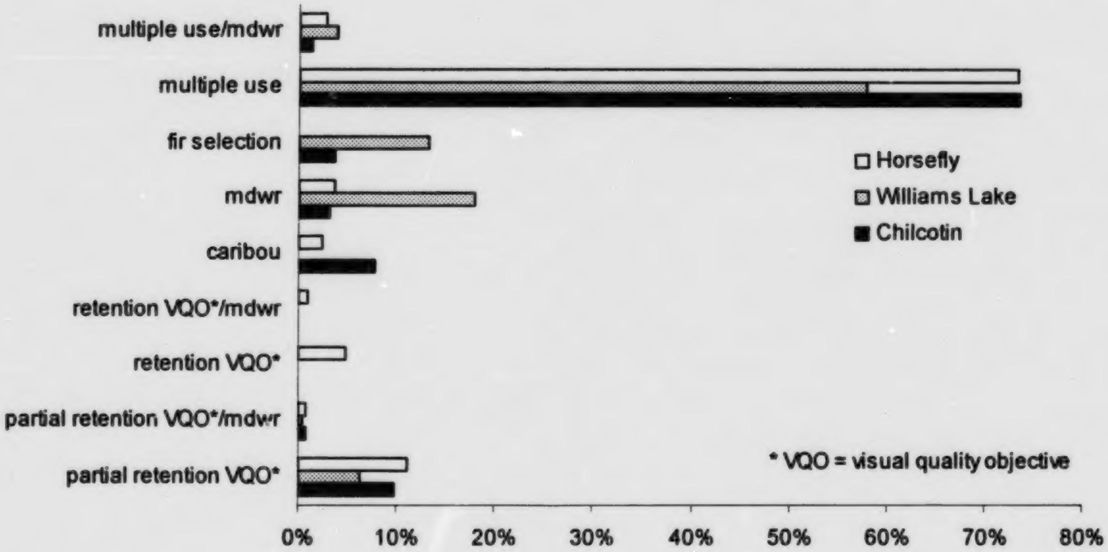

*Figure 5. Timber harvesting land base by resource emphasis — Williams Lake TSA timber harvesting land base, 2001.*

***Analysis unit***
*A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables.*

An additional focus in the analysis is the maintenance of different amounts of forest of different ages for biodiversity considerations. Figure 6 shows the area distribution of assigned biogeoclimatic (BEC) variants that have at least 25 000 hectares of timber harvesting land base. These 15 variants represent 96% of the timber harvesting land base. The percentage figures represent the proportion of timber harvesting land base in each BEC variant.

In the base case, biodiversity requirements for both old- and mature-forest are applied at the landscape unit, BEC unit level.

Figure 6 provides a TSA-level overview by BEC unit, which indicates that several of the BEC variants which contribute significant areas to the timber harvesting land base also contain significant amounts of forest outside of the timber harvesting land base that can meet these requirements (e.g., SBPSxc represents 29% of the timber harvesting land base and 29% of the variant is outside of the timber harvesting land base). However in some BEC variants, old forest representation must come from the timber harvesting land base, as there is little forest outside of the timber harvesting land base to provide the requirement (e.g., SBSdw2, SBPSmk).

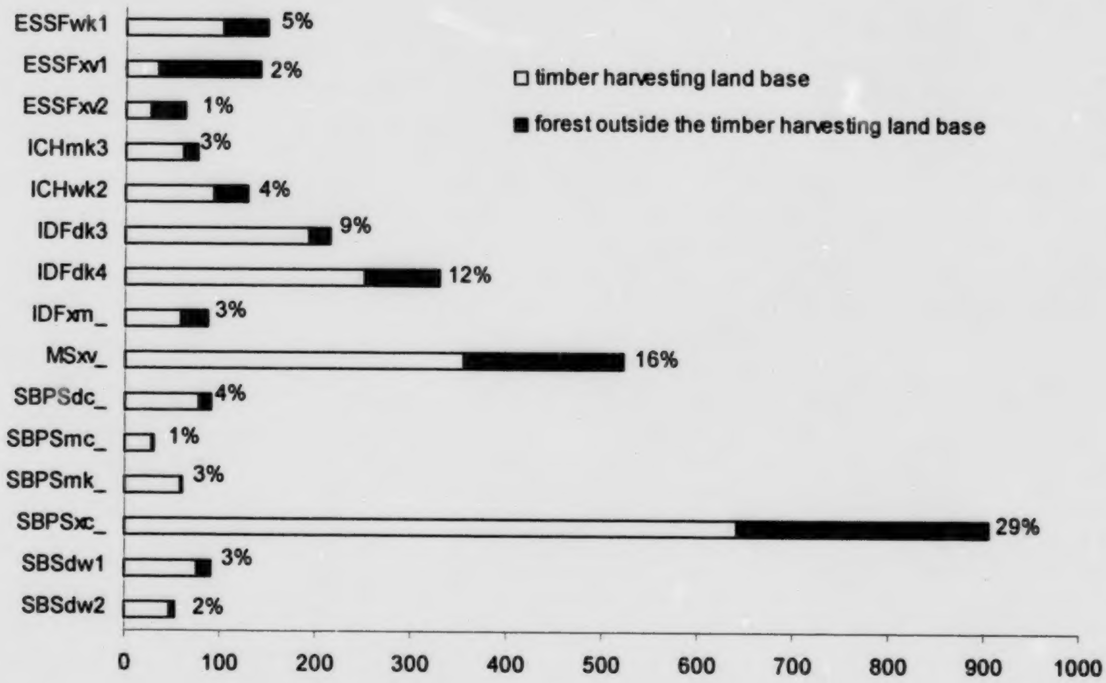

*Figure 6. Forested area by biogeoclimatic classification — Williams Lake TSA, 2001.*

# 3 Timber Supply Analysis Methods

The purpose of this analysis is to examine both the short- and long-term timber harvesting opportunities in the Williams Lake TSA under current forest management practices. A timber supply computer simulation model developed by the British Columbia Forest Service was used for the analysis (FSSIM version 3.3). A timber supply model, as distinct from a growth and yield model, assists the timber supply analyst in generating harvest forecasts* (supply of timber over time) using a set of forest management assumptions*. The simulation model uses information about the timber harvesting land base, timber volumes, and the management regime to represent how forests grow and are harvested over hundreds of years. There is no presumption that the future can be known hundreds of years from now; the analysis horizon simply reflects that forest-level changes often occur over very long time periods. Generally, only the results for the first 250 years are shown graphically in this report because the projected harvest remains constant after that time.

Similar to other models, the British Columbia Forest Service model assumes that trees grow according to specified yield projections and are harvested according to either a volume target or a specified objective set by the analyst. The Forest Service model also allows the use of forest cover guidelines that specify the desired age composition of the forest. These guidelines can be used to examine the effects of cutblock adjacency* and green-up* prescriptions. For example, guidelines might specify that no more than some maximum percentage of the forest can be younger than a specified green-up age, or that some minimum percentage of the forest must be in older age classes to provide wildlife habitat. The British Columbia Forest Service simulation model facilitates examination of the effects of such guidelines on timber supply.

This type of analysis is used to determine the timber supply implications of a particular forest management regime. The results of the analysis are especially important in determining allowable cuts that will not restrict options of future resource managers, and that will assist local British Columbia Forest Service staff to administer their programs according to relevant guidelines and principles. However, the results of the analysis are not meant to be taken as recommendations of any particular AAC.

The main results of the analysis are forecasts of potential timber harvests and timber inventory changes (ages and volumes) over time. Although this information gives field staff only limited guidance in the design of operational activities such as harvesting block location and silviculture planning, it does help ensure that the timber harvest level supports rather than hinders sustainable forest management in the field.

***Harvest forecast***
*The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized over time for a specified land base and set of management practices. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.*

***Management assumptions***
*Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.*

***Cutblock adjacency***
*The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions.*

***Green-up***
*The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas.*

# 4 Results

This section presents results of the timber supply analysis for the Williams Lake TSA. The base case harvest forecast* detailed in Section 4.1 uses the most recent assessments of current forest management, the land available for timber harvesting, and timber yields as described in Section 2, "Information Preparation for the Timber Supply Analysis." Because forest management is inherently a long-term venture, uncertainty surrounds much of the information important in determining timber supply. This uncertainty will be discussed in Section 5, "Timber Supply Sensitivity Analyses." The base case provides only a part of the timber supply picture for the Williams Lake TSA, and should not be viewed in isolation of the sensitivity analyses.

## 4.1 Base case harvest forecast

The base case harvest forecast represents one feasible projection of timber supply. The current AAC for the Williams Lake TSA of 3 807 000 cubic metres per year includes volume which has been issued to woodlots since the last AAC determination. Subtracting this contribution (about 23 600 cubic metres per year) from the current AAC gives a reference harvest of 3 783 400 cubic metres per year. In generating the base case forecast, a number of harvest targets were used to reflect the partitions that currently exist within the Williams Lake TSA. Table 5 summarizes the existing partitions and the average annual harvest for the first thirty years in the base case.

*Table 5. Short-term harvest in the base case harvest forecast — Williams Lake TSA, 2001*

| Partition category | Current partitioned AAC | Average annual harvest ($m^3$/year) for the first 5 years of modelling | Annual harvest ($m^3$/year) for subsequent 25 years of modelling |
|---|---|---|---|
| Main TSA conventional harvest | 2 500 000 | 2 515 226 | 2 223 795 |
| Salvage of mountain pine beetle (MPB) attacked stands (main TSA and western supply blocks) | 850 000 | 594 602 | 0 |
| Pulpwood Agreement (PA) 16 (part of the main TSA) | 107 000 | 107 000 | 107 000 |
| 3 western supply blocks | 350 000 | 548 172 | 589 205 |
| Total TSA harvest | 3 807 000[1] | 3 765 000 | 2 920 000 |

Note (1): Approximately 23 600 cubic metres per year are attributable to woodlot licences issued since the last AAC determination. Therefore, the AAC attributable to the TSA is 3 783 400 cubic metres.

An active mountain pine beetle salvage program has been in place in the Williams Lake TSA since the mid-1980's. The current partition volumes shown in Table 5 reflect the total volume attributed to salvage operations. During modelling, salvage harvest occurs for the first five years at approximately 595 000 cubic metres per year. This accounts only for merchantable volume of standing living trees and not for any salvage of dead trees that will occur to the degree that dead trees still have some commercial value. It is possible that a total salvage close to the current partition may still be attainable by including this dead tree component.

***Base case harvest forecast***
*The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.*

# 4 Results

Figure 7 shows the base case harvest which will be used as the reference point for evaluating the sensitivity of timber supply to uncertainties and harvest flow options. The starting harvest level of 3.765 million cubic metres per year is maintained for 5 years until the termination of the salvage harvest in MPB attacked stands. The harvest declines about 22% to a medium-term harvest level of 2.92 million cubic metres per year until rising by 11% in decade 18 to the long-term harvest level* of 3.25 million cubic metres per year. Harvest contributions from the western supply blocks and main TSA are shown. The timber supply projections are the result of different harvesting histories. The main TSA possesses more productive growing sites and more stands that are considered to be managed so an increase to the long-term harvest level of 2.56 million cubic metres per year can occur in decade 18. The western supply blocks, with a higher proportion of existing natural stands and less productive sites is unable to support the long-term harvest level of 690 000 cubic metres until about decade 20. These two components of the base case TSA harvest levels will be shown as additional references in all sensitivity analysis. For simplification, the contribution from PA 16 is included in the main TSA harvest level. Recall that the current AAC referenced in Figure 7 includes 23 600 cubic metres attributable to woodlot licences issued since the last determination.

Due to the timing of the most recent updates and inventory projection, the forecast starts in 1998. Therefore, at the time this analysis was released, about three years had passed from time 0.

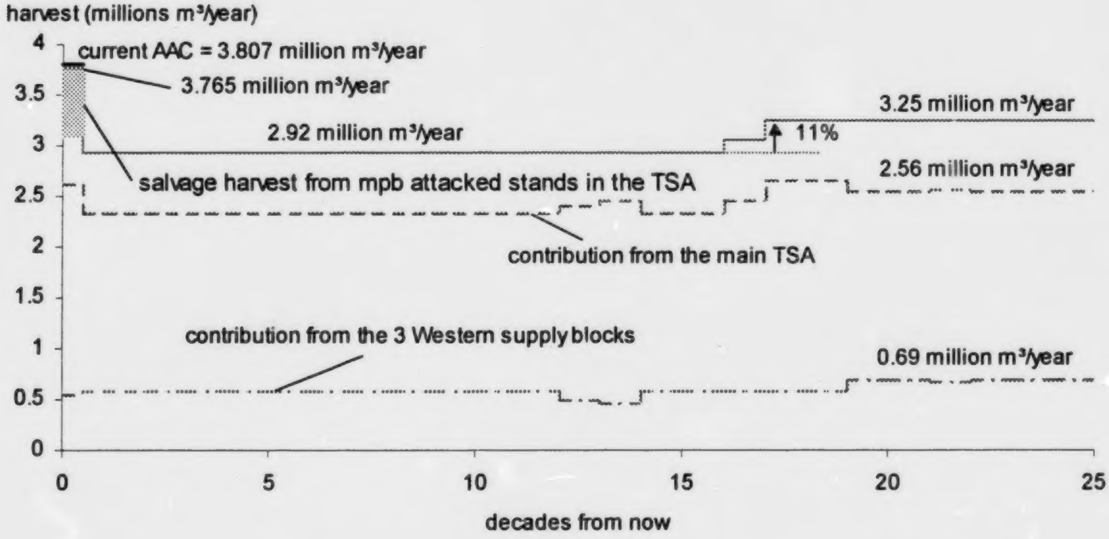

*Figure 7. Base case harvest forecast for the Williams Lake TSA, 2001.*

***Long-term harvest level***
*A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.*

# 4 Results

The timber supply outlook in the Williams Lake TSA has changed significantly with the redefining of minimum merchantability criteria based on an operational review. The result is an increase in the size of the timber harvesting land base and an increase in timber supply flexibility due to a reduction in minimum harvestable age for most timber types. Managed stands are shown in Figure 8 to contribute almost 50% of the total TSA harvest in 80 years time. However, since the transition of harvesting from existing to managed stands occurs over many decades, it is not until 180 years from now that the projected harvest rises to the long-term harvest level supported almost entirely by the harvest of managed stands. This does not mean that managed stands are not available for harvest earlier than 180 years from now. In fact, many stands are available earlier in the forecast, but the peak of total managed stand volume does not occur for 180 years (see Figure 9).

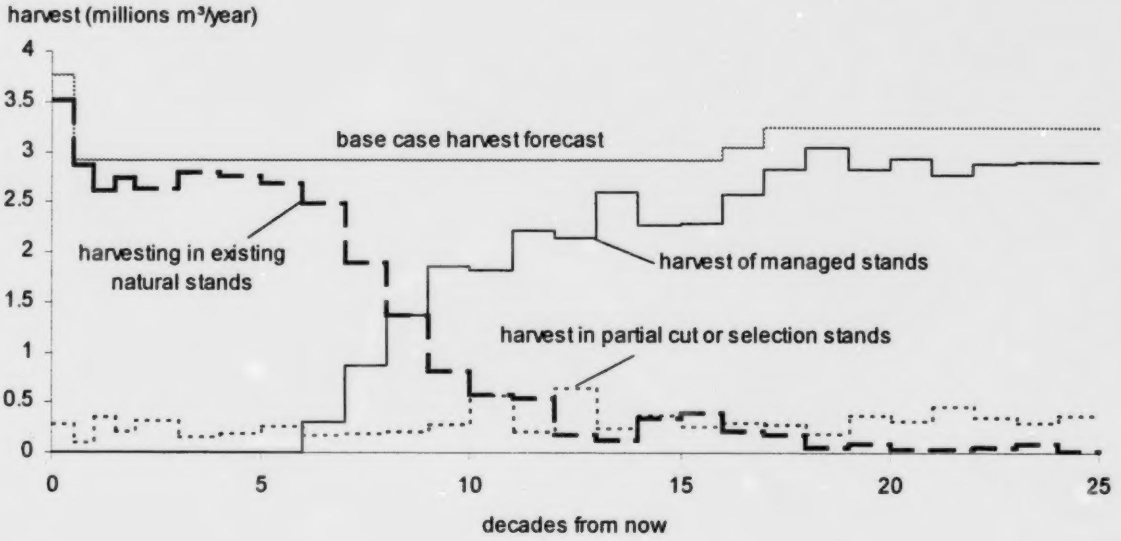

*Figure 8. Transition from harvesting existing natural stands to managed forest — Williams Lake TSA, 2001.*

# 4 Results

Figure 9 illustrates the change in merchantable volume from managed stands. Total growing stock* (excluding stands initially deferred from harvest) remains at about 200 million cubic metres. The growing stock in all selection management types is about 60 million cubic metres. The managed stand growing stock above minimum harvestable age rises to about 50 million cubic metres in eighty years and reaches a maximum of about 120 million cubic metres in about 170 years where it remains reasonably stable.

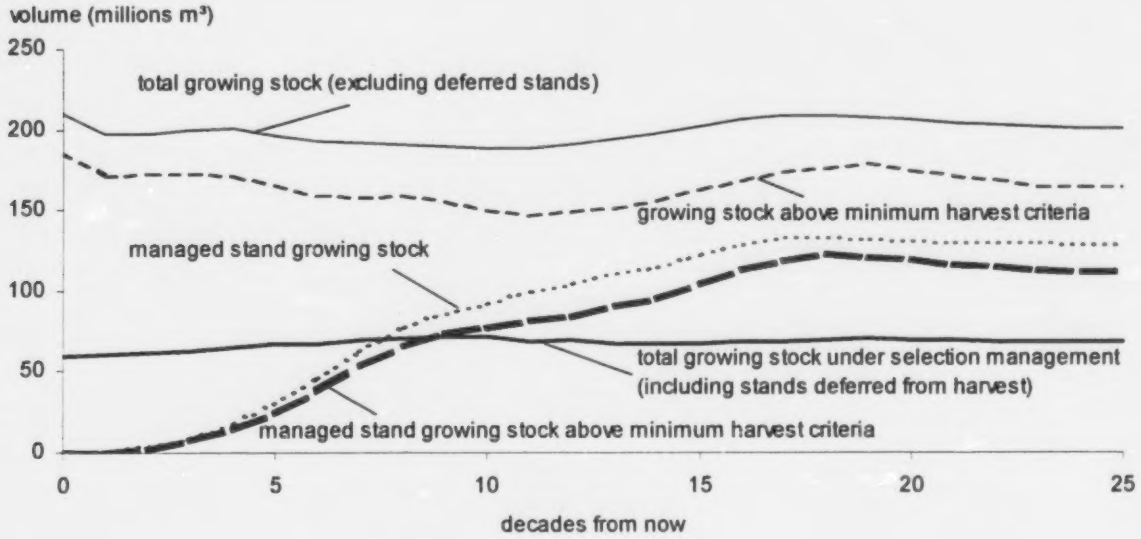

*Figure 9. Total growing stock through time — Williams Lake TSA, 2001.*

***Growing stock***
*The volume estimate for all standing timber at a particular time.*

## 4.2 Harvesting statistics

Figure 10 provides the harvest contribution by forest district. Harvest from the Williams Lake Forest District is less cyclical than the other two forest districts because of the amount of partial harvesting, and the staggered deferrals from harvest in the mule deer winter range areas that occur in the Williams Lake District. This is not the case for the other two forest districts. With the relative-oldest first harvest rule (i.e., highest priority for harvest given to stands where the difference between current age and the minimum harvestable age is the greatest), the short-term harvest is higher in the Horsefly Forest District with its relative abundance of older spruce trees. As the harvest in the Horsefly Forest District declines, the harvest increases in the younger pine stands in the Chilcotin Forest District.

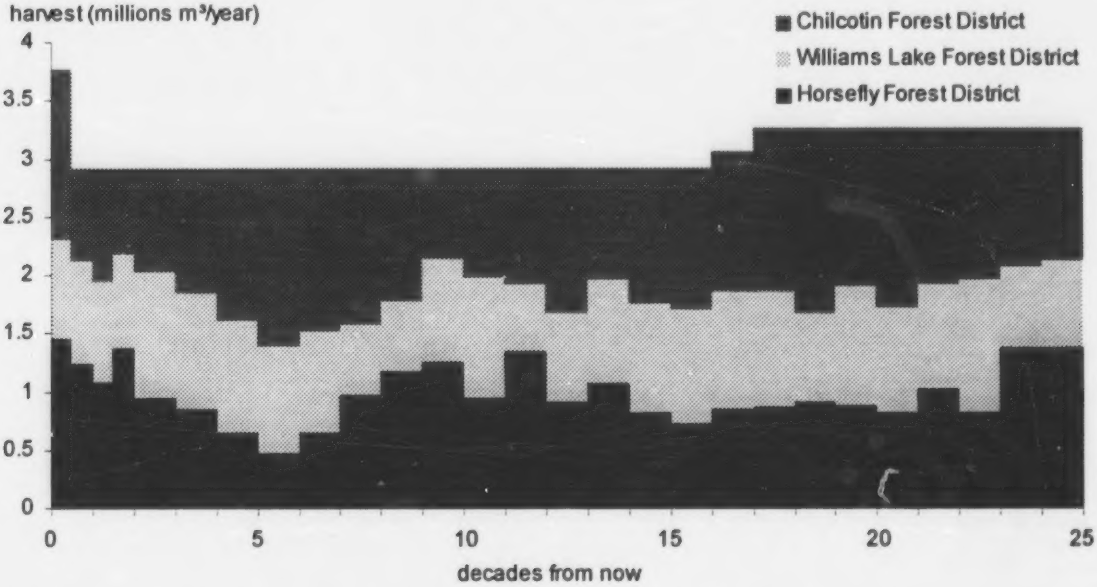

*Figure 10. Harvest contribution by forest district — Williams Lake TSA, 2001.*

# 4 Results

Stands eligible for the PA 16 partition are located in the main TSA. For reporting, the harvest from the PA 16 types is included in the harvest from the main TSA. Figure 11 shows that the current partition of 107 000 cubic metres per year can be maintained for 30 years. After 100 years, the contributions are the result of the regeneration occurring on these sites.

Figure 11 also shows two alternative harvest contributions from the Anahim supply block (SB A) which is one of the three western supply blocks. One forecast fluctuates, somewhat, while a non-declining harvest forecast starts at 268 970 cubic metres per year before rising after 190 years to a long-term sustainable level of 318 970 cubic metres per year. Either contribution level enables the total TSA harvest level to be attained.

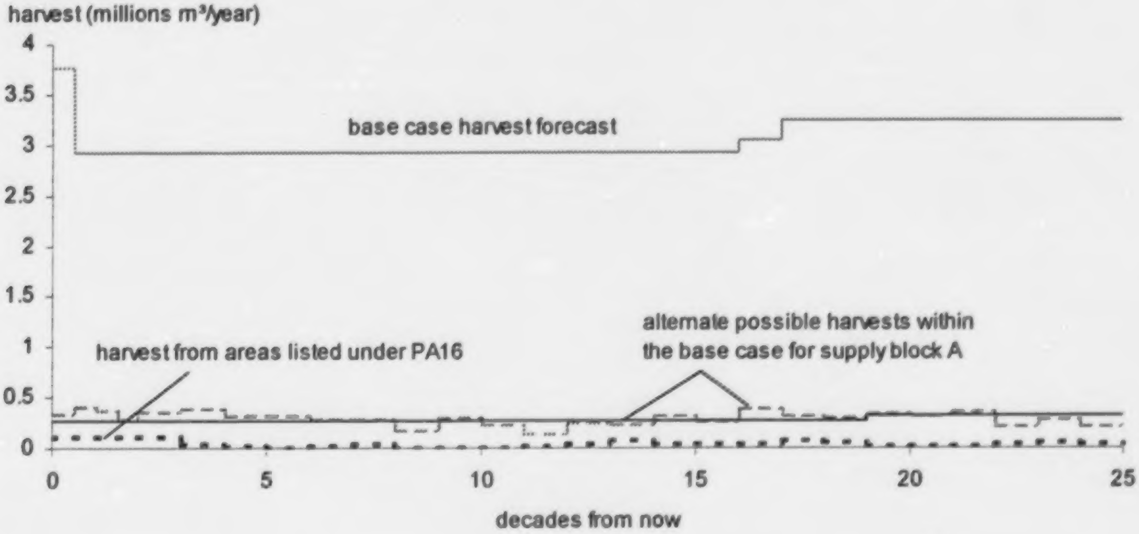

*Figure 11. Harvest contributions of the Anahim supply block (SB A) and PA 16 — Williams Lake TSA, 2001.*

# 4 Results

Projected harvest from the area within the *Innovative Forest Practices Agreement* (IFPA) area held by Lignum Limited generally ranges between 350 000 and 450 0000 cubic metres per year, although it does approach 600 000 cubic metres per year in decade 13.

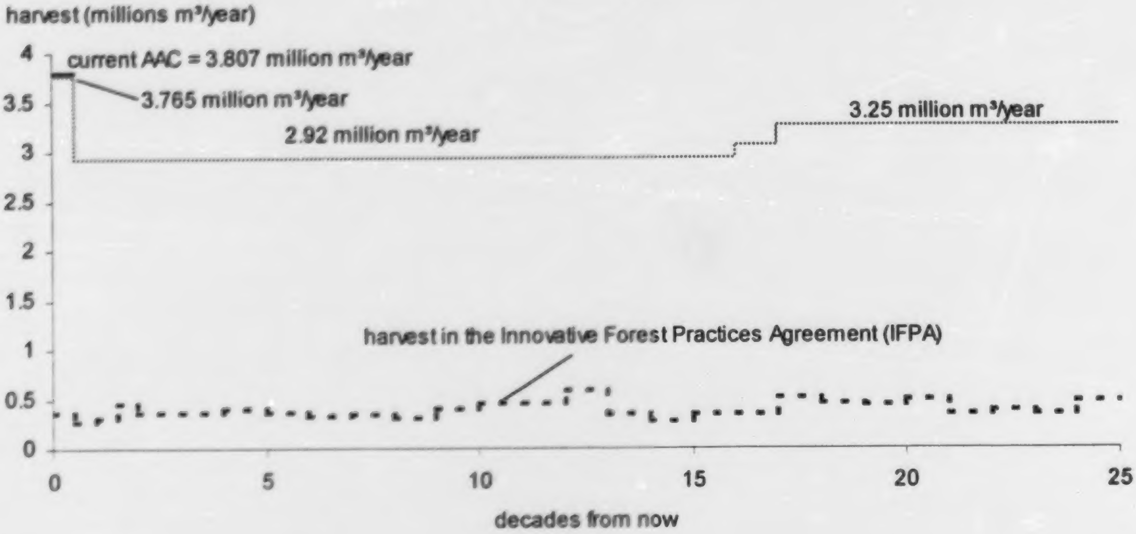

*Figure 12. Harvest contribution from the Innovative Forest Practices Agreement (IFPA) area — Williams Lake TSA, 2001.*

# 4 Results

Figure 13 provides the average volume per hectare for various portions of the TSA. The average volume per hectare harvested in the TSA as a whole is just below 150 cubic metres per hectare in the first decade rising to an average of around 175 cubic metres per hectare. The initial low volume per hectare is a result of the salvage harvest occurring in the first 5 years of modelling. Volumes from the clearcut multiple use group are always 30 to 40 cubic metres per hectare higher than the average. Stands in the western supply blocks have an average harvest volume of about 130 cubic metres per hectare. Volume per hectare in partially harvested stands declines from about 100 cubic metres to about 80 cubic metres per hectare over several decades. The initial higher average volumes reflect the higher rate of volume removal on first entry. In addition, while minimum return intervals were explicitly stated for partial harvest stands (except for caribou modified harvest), these stands were not given any explicit priority, allowing them to accumulate more volume than if harvested exactly at the return interval.

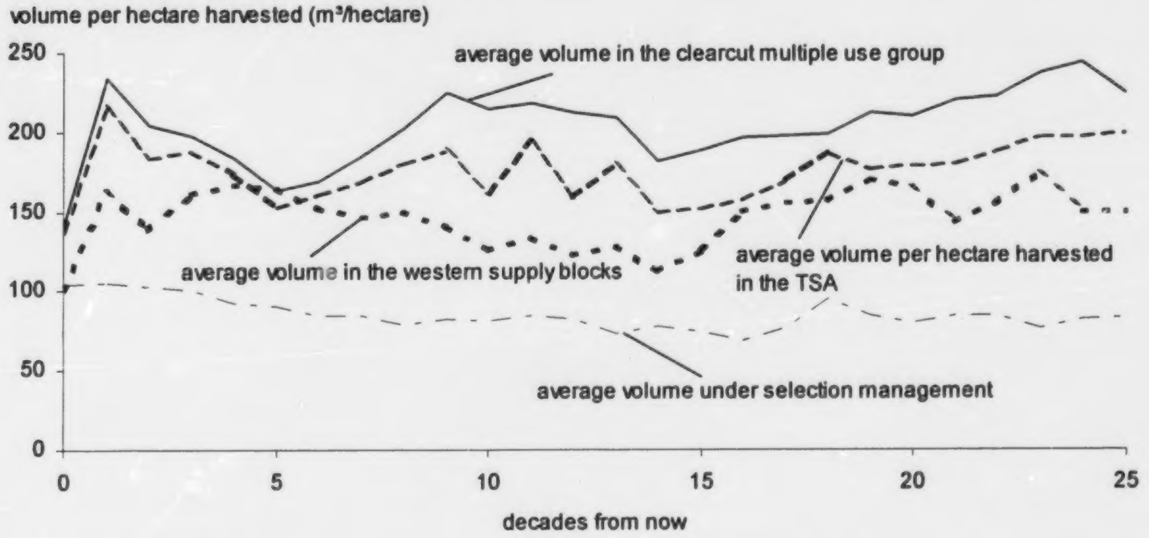

*Figure 13. Average volume per hectare harvested — Williams Lake TSA, 2001.*

# 4 Results

The large short-term decline in annual area harvested seen in Figure 14 coincides with the cessation of salvage harvest. Average annual harvest over the analysis horizon is projected to be about 18 000 hectares per year, with half of the harvested area coming from the Chilcotin Forest District.

Productivity differences among the forest districts become evident when comparing the harvest volume contribution with harvested area. For example, the Horsefly district contributes about 30% of the volume, while the harvested area projected for that district is only about 20%.

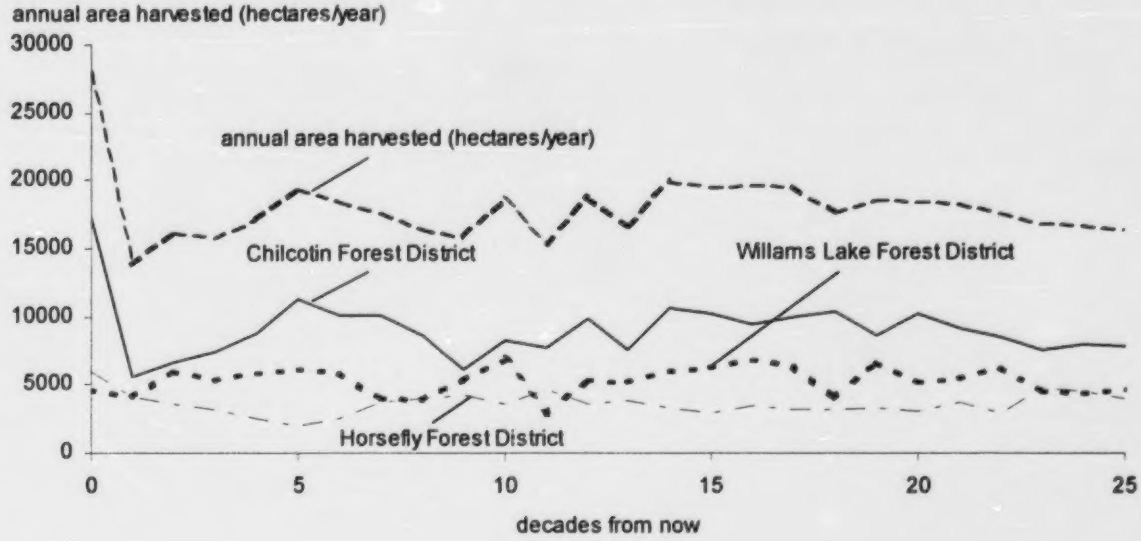

*Figure 14. Annual area harvested by forest district — Williams Lake TSA, 2001.*

Average area-weighted harvest age can be seen in Figure 15. Declines from the initial average of 195 years continue until harvest age reaches a stable average of about 140 years by decade 11. Harvest age in multiple use areas is 20 years below the TSA average of 120 years of age. Over the long term, harvest age in partial retention visual areas is about 10 years above stands in multiple use areas, and about 10 years lower than the TSA average. This indicates that while the rate of harvest is slower in the partial retention areas and causes an older average harvest age in the short to medium term, over the long term the partial retention areas are expected to be harvested at similar ages to the multiple use areas.

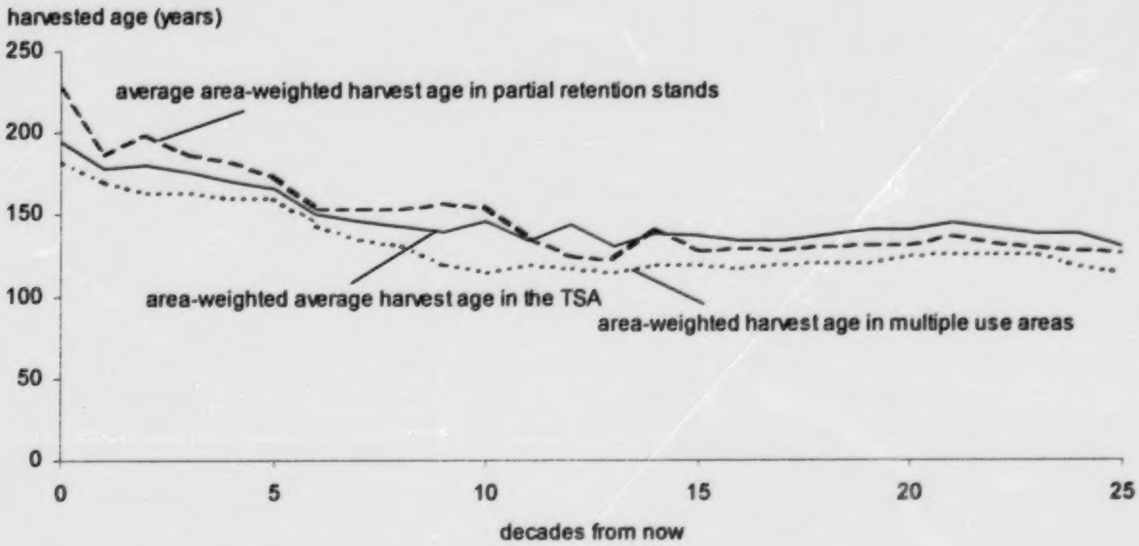

*Figure 15. Average harvest age — Williams Lake TSA, 2001.*

## 4.3 Age class profile over time

The charts in Figure 16 show how the age composition of the forest both in the timber harvesting land base and in stands outside the timber harvesting land base is projected to change over time under the base case harvest forecast.

As noted earlier in Section 2, there is a small proportion of stands above 250 years of age. One consequence of this is that the old-growth requirements for landscape-level biodiversity* in some variants, predominantly in the Interior Douglas-fir (IDF) biogeoclimatic zone, are not met for many periods into the harvest forecast. This lack of older forest in some biogeoclimatic variants* in some landscape units does not necessarily mean that merchantable forest cannot be harvested. The forest estate model used by the British Columbia Forest Service reserves some of the oldest forest below the desired age needed to meet old-growth objectives as soon as possible. Therefore, some forested areas younger than 250 years in the IDF are reserved to meet old-growth requirements. Reserving of stands for a long time extends the period over which existing stands are harvested, and results in small fluctuations in average volume and area harvested into the long term.

***Landscape-level biodiversity***
*The* Landscape Unit Planning Guide *provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity.*

***Biogeoclimatic (BEC) variant***
*A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.*

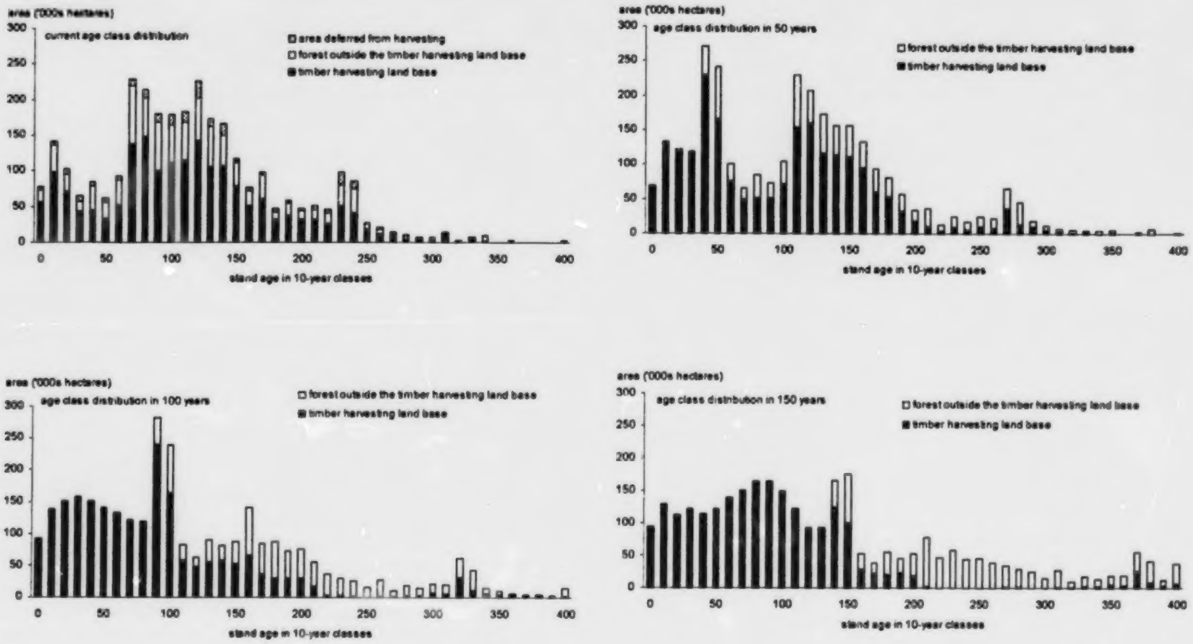

*Figure 16. Age profile through time — Williams Lake TSA, 2001.*

# 5 Timber Supply Sensitivity Analyses

The best available information on forest inventories and management practices is used to analyse the timber supply implications of continuing with current management. However, forest management is a complicated endeavour that must account for diverse and changing human values, the dynamics of complex ecosystems, and fluctuating and uncertain economic factors. As well, forests grow quite slowly in terms of human life spans, which means that decisions we make today have not only short-term but also long-term effects. In such a context, we cannot be certain that all data accurately reflect the current state of all values in the forest, how the forest will change, or how our management activities will affect the forest.

One important way to deal with this uncertainty is to revise plans and analyses frequently to ensure they incorporate up-to-date information and knowledge. Frequent planning and decision-making can help minimize any negative effects that may occur if decisions are based on inaccurate information. Frequent revision can also ensure that opportunities that become apparent from new information are not missed.

Another important way of dealing with uncertainty is to assess how values of interest, for example, timber supply, could change if the information used in the analysis is not accurate. Sensitivity analysis* is one way of evaluating how uncertainty could affect analysis results, and ultimately decision-making. Sensitivity analysis can highlight that fairly small uncertainties about some variables could have large effects on timber supply projections, or conversely that fairly large inaccuracies in others could have negligible effects. Also, sensitivity analysis could show that some variables affect timber supply more in the short term than in the long term, while others have the opposite effect. Sensitivity analysis can highlight priorities for collecting information for future analyses, and show which variables, and associated uncertainties, have the most significance for decisions. It can clarify whether current best estimates provide a safe basis for decisions, or whether high uncertainty about important variables means more conservative decisions may be wiser.

In this section, results of several sensitivity analyses are discussed. The results that are based on current forest management assumptions (shown in Figures 7 to 16) are referred to as the base case. Harvest contributions from the western supply blocks and the main TSA are shown with the overall TSA harvest in all graphs.

Unsalvaged losses to natural forces such as insects and fire are estimated to be 53 500 cubic metres per year for the entire 250-year horizon, and have been subtracted from all harvest forecasts shown in this report.

***Sensitivity analysis***
*A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case.*

# 5 Timber Supply Sensitivity Analyses

## 5.1 Alternative harvest flows over time

When generating the base case harvest forecast shown in Figure 7, the highest medium-term timber supply was maintained, subject to achieving a long-term harvest level that reflects the productivity of the timber harvesting land base. As discussed in Section 4.1, the base case forecast is simply one feasible harvest forecast. Figures 17 and 18 show two alternatives.

Given the flexibility provided by young minimum harvestable ages, an even-flow harvest higher than the base case in the medium term can be achieved. Figure 17 illustrates this even-flow harvest forecast, which at 3.05 million cubic metres, is about 130 000 cubic metres more than the base case in the medium term. However, increasing the medium-term harvest means managed stands are harvested earlier than in the base case, with the result that the 3.25 million cubic metres per year long-term level projected in the base case cannot be achieved. The even-flow forecast results in a decline in the average total growing stock over the long term to about 170 million cubic metres, 30 million cubic metres less than in the base case. The lower long-term level is the result of a higher sustained medium-term harvest and the more rapid dependence on managed stands. The even-flow forecast results in projected area-weighted harvest ages about 20 to 30 years younger than in the base case, and a reduction in average harvest volume of about 30 to 40 cubic metres per hectare.

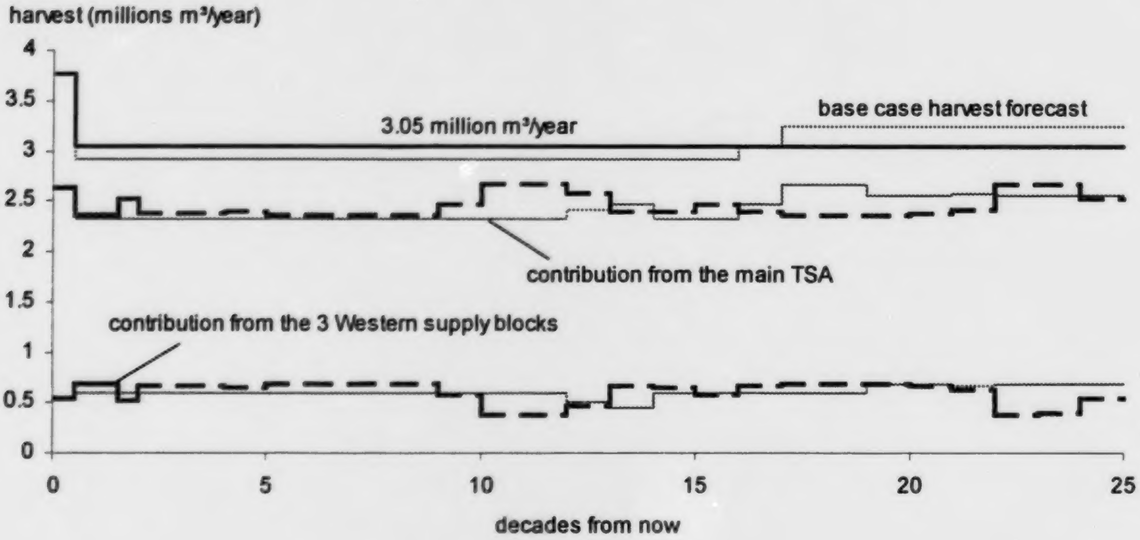

*Figure 17. Even-flow harvest forecast after salvage harvest terminated — Williams Lake TSA, 2001.*

# 5 Timber Supply Sensitivity Analyses

Another harvest forecast was used in developing an understanding of the maximum long-term productivity of the Williams Lake TSA timber harvesting land base in the context of all management and forest cover requirements. For this forecast, minimum harvestable ages were set at the age when stands achieve their maximum average growth rate. This reduces flexibility significantly as stands must reach this age before being eligible for harvest. Figure 18 shows that the base case initial harvest level could be maintained for one decade, followed by a managed decline to the medium-term harvest level of about 2.7 million cubic metres per year before rising in decade 18 to a long-term harvest level of 3.3 million cubic metres. The medium-term harvest level shows some disruptions during periods when insufficient volume above culmination age* is available to meet the harvest request. The base case achieves within 50 000 cubic metres of the maximum long-term harvest level while providing over 220 000 cubic metres per year more volume in the medium term. The base case requires some stands to be harvested before achieving their maximum average growth rate but not to the degree that the even-flow harvest forecast does, as evidenced by the very small impact on the long-term harvest.

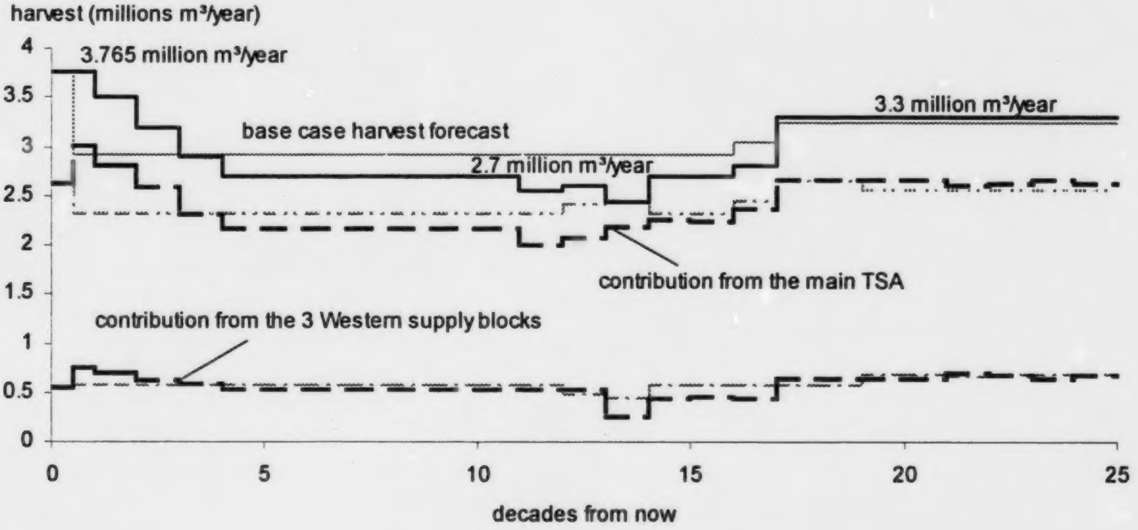

*Figure 18. Maximum long-term productivity from current management — Williams Lake TSA, 2001.*

***Culmination age***
*The age at which a timber stand reaches its highest average growth rate, or mean annual increment (MAI). MAI is calculated as stand volume divided by stand age. Culmination age is the optimal biological rotation age to maximize long-term volume production from a growing site.*

## 5.2 Analyses with expected or negligible impacts

Sensitivity analyses often produce results that are intuitively expected, or results very similar to the base case harvest forecast. Sensitivity analyses which fit either of these two conditions are summarized in Table 6. For most of these sensitivity analyses, if not otherwise stated, medium-term timber supply was adjusted when the factor would not normally have a long-term implication. For example, changes to the volume estimates for existing stands would not normally be expected to affect the long-term productivity of the land base. In these cases, if adjustments were not made in the medium term to correspond to changes in the value of inputs, the impacts could be deferred to the long term, which would not accurately reflect the role of the variable in defining timber supply.

A notable result shown in the table relates to the correction to the volume adjustment factor applied to pine stands outside of the IDF and SBPS BEC zones. The adjustment made for that sensitivity analysis reflects the corrected value for these stands rather than the ratio from the draft volume adjustment report which was used in the base case (see Section A-1, "Inventory Information").

*Table 6. Sensitivity analyses with expected or negligible impacts — Williams Lake TSA, 2001*

| Factor being considered | Timber supply implication in the first 150 years | Long-term timber supply implication |
|---|---|---|
| Increase green-up age by 10 years. | About 70 000 $m^3$/year (2.4%) less in decade 5. | Nil. |
| Reduce the maximum allowable disturbance in multiple use and partial retention areas by 5 points (e.g., 15% becomes 10%). | Nil. | Nil. |
| Increase existing natural stand yields by 10%. | Increase medium term by 8% (to 3.15 million $m^3$/year). | Nil. |
| Decrease existing natural stand yields by 10%. | Decrease medium term by 7% (to 2.72 million $m^3$/year). | Nil. |
| Increase managed stand yields by 10%. | Nil. | Increase long-term timber supply by 10% (3.55 million $m^3$/year) 3 decades earlier. |
| Decrease managed stand yields by 10%. | Decrease medium term by 4% (to 2.8 million $m^3$/year). | Decrease long term by 10% (to 2.95 million $m^3$/year). |
| Reduce the ages selection stands regenerate to after harvest (50 years for normal fir selection and 80 years for all other types)[1]. See Section A.4.7. for ages used in the base case. | Decrease medium term by 1% (to 2.88 million $m^3$/year). | Decrease long term by 2% (to 3.15 million $m^3$/year). |
| Apply an early-seral requirement in each landscape unit by BEC variant. | Decrease harvest in years 16 through 20 by 28 000 $m^3$/year (1%). | Nil. |
| Allow a drawdown of the old-seral* requirement in landscape units with enhanced or integrated resource management (IRM) zones (CCLUP). | Increase medium term by about 1% (to 2.94 million $m^3$/year). | Nil. |
| Correct the volume adjustment factor for existing pine stands outside IDF or SBPS BEC zones[2]. | Increase the medium term by 3% (to 3.0 million $m^3$/year). | Nil. |
| Use VRI net volume adjustment factors rather than provincial loss factors. | Increase the medium term by 4% (to 3.05 million $m^3$/year). | Nil. |

Note (1): This sensitivity analysis was done to examine the potential impacts of a reduction in the degree to which stands recently selection-harvested will meet mature or old seral characteristics

(2): Source Smith S. 2000. "An examination of volume adjustment factors for the Williams Lake TSA."

***Old seral***
*Old seral refers to forests with appropriate old forest characteristics. Ages vary depending on forest type and biogeoclimatic variant.*

## 5.3 Uncertainty in the minimum harvestable age

One of the key changes between the last analysis (TSR 1) and the current analysis is the definition of minimum harvestable age. The previous analysis used regional harvest guidelines which state that pine stands need to be at least 80 years of age before being eligible for harvest and all other species must reach an age of 120 years. This operational rule has been implemented to ensure that potential volume growth is not lost by harvesting young stands that are still growing at rates close to maximum, instead of harvesting older stands that are growing slowly if at all, or are at high risk of loss. In this analysis, the minimum harvestable age was determined as the minimum time required to reach a merchantable height and volume depending on district criteria (see Section A.4.3, "Minimum criteria and minimum harvestable age"). In general, both height and volume thresholds are predicted to be achieved at early ages in managed stands. Two analyses were used to examine the sensitivity of the base case to the old (TSR1) criteria and to the new criteria.

### 5.3.1 Effect of minimum harvestable ages based on regional harvest age guidelines

The TSR 1 harvest ages were used for the sensitivity analysis shown in Figure 19. There are timber supply reductions in both the medium and long term relative to the base case. The harvest in the western supply blocks remains reasonably similar to the base case while there is a reduction in harvest in the main TSA. Using these TSR 1 minimum harvestable ages results in a lower average harvested volume per hectare than occurs in the base case. Also, the transition to the harvest of managed stands occurs 20 years later than in the base case, requiring a reduction in harvest in the medium term to ensure an adequate volume of timber is available until these stands become eligible for harvest. Table A-22, "Minimum harvestable ages" shows that the maximum average growth rate actually occurs before 120 years of age for many managed spruce stands. Retaining these stands past the age of maximum average growth will result in some foregone volume in the long term.

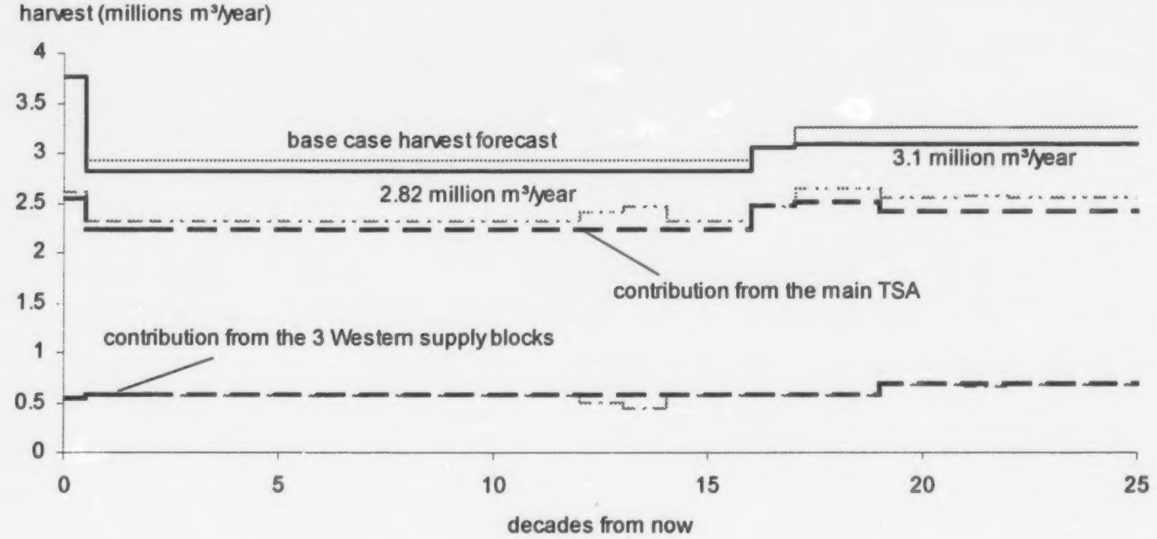

*Figure 19. Implications of using a minimum harvestable age based on regional harvest age guidelines — Williams Lake TSA, 2001.*

### 5.3.2 Increase minimum harvestable age by 40 years

Many of the minimum harvestable ages in managed stands can be as low as 40 years of age. Figure 20 shows the timber supply implications of increasing the minimum harvestable age used in the base case by 40 years. Despite a significant increase in the minimum harvestable age, the base case harvest forecast can be maintained except for small disruptions in decades 14 and 15 that could be eliminated with minor adjustments to the medium-term timber supply. The size of the disruption is due in part to the reduction in the salvage of MPB-attacked stands with the increase in minimum harvestable age. The older ages cause an increase in conventional harvest in the short term, and the MPB-attacked stands are transferred to a young existing natural stand rather than being salvage harvested and regenerated as managed stands. This, combined with the longer time until managed stands reach merchantability, combine to reduce the amount of managed forest available for harvest in decade 14 and 15. In the base case, stands are allowed to grow well beyond the minimum harvestable age, which ensures the maintenance of the long-term harvest level. Harvesting stands at the minimum harvestable age would produce a long-term harvest level for the Williams Lake TSA of about 2.6 million cubic metres, 650 000 cubic metres below the base case long-term harvest level.

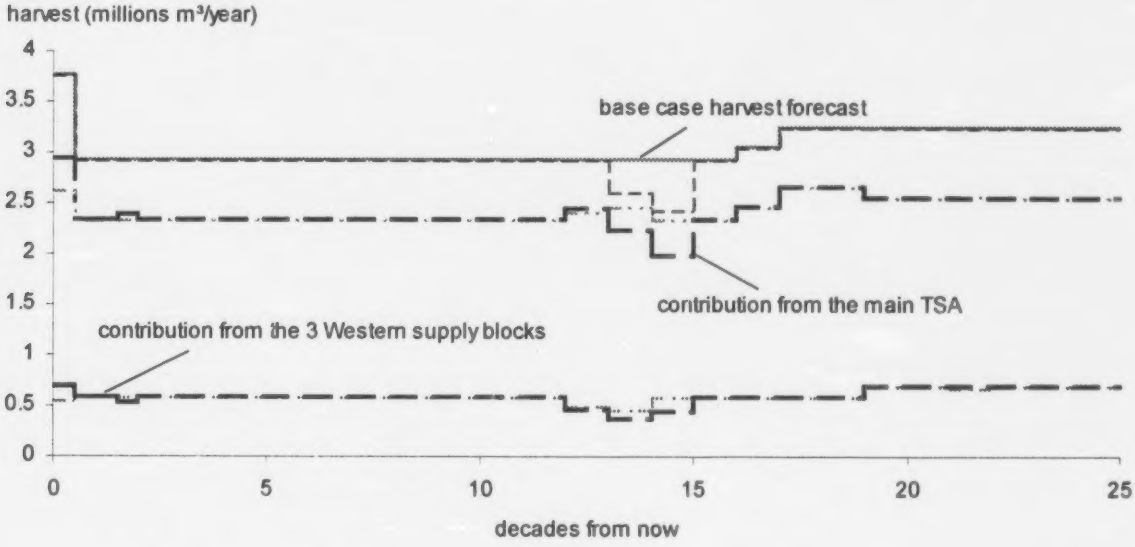

*Figure 20. Implications of increasing minimum harvestable ages by 40 years — Williams Lake TSA, 2001.*

## 5.4 Uncertainty in the maximum allowable disturbance in multiple use areas

In the base case, the maximum allowable area not meeting green-up requirements in the multiple use area within each landscape unit was 30%. This means that for every one hectare of recent harvest in the multiple use area in a given landscape unit, just over two hectares of timber harvesting land base must be at or above green-up age. The 30% limit on disturbance did not constrain timber supply. No timber supply implications occur until the allowable disturbance level is reduced to 18%. These results assume that it is possible to harvest in all landscape units at any time, so that when the disturbance limit is reached in one area, harvesting can shift to another.

Figure 21 shows that when the maximum area below green-up is set at 18%, there is a reduction in harvest of 9% in the second decade and then further disruptions throughout the time horizon. The allowable disturbance level of 18% is a threshold after which further reductions produce corresponding reductions in medium- and long-term timber supply. If the maximum disturbance were reduced to 15%, total TSA harvest in the second decade would drop to about 2.2 million cubic metres per year. Timber supply in the three western supply blocks is not as sensitive to more constraining limits on disturbance as in the main TSA. This is related to the extensive harvesting history in the main TSA.

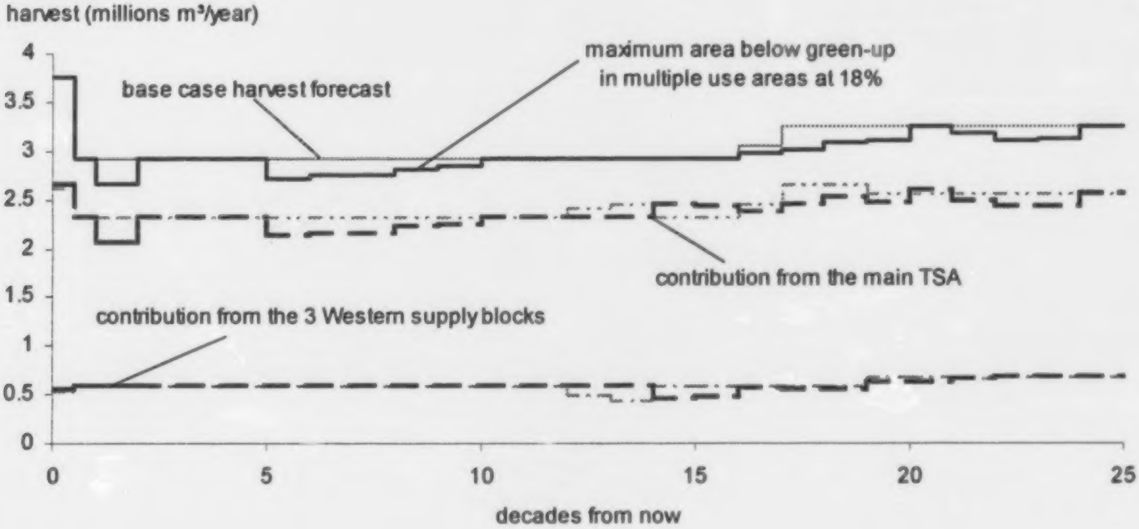

*Figure 21. Implications of reducing the maximum allowable disturbance in multiple use areas to 18% — Williams Lake TSA, 2001.*

## 5.5 Uncertainty in the allowable disturbance in partial retention visual management areas

As noted in the base case discussion of average harvest age (Section 4.2, Figure 15), the average harvest age over the long term in areas being managed for partial retention VQOs is about 130 years. If the maximum allowable disturbance is decreased to 6% from the base case level of 15%, the average harvest age almost doubles to 240 years of age. This change reduces the long-term timber supply contribution of partial retention areas from 10% in the base case to about 5%. Overall TSA timber supply is reduced to 2.82 million cubic metres per year in the medium term and 3.15 million cubic metres per year in the long term. This reduction in volume contribution occurs almost completely in the main TSA as seen in Figure 22.

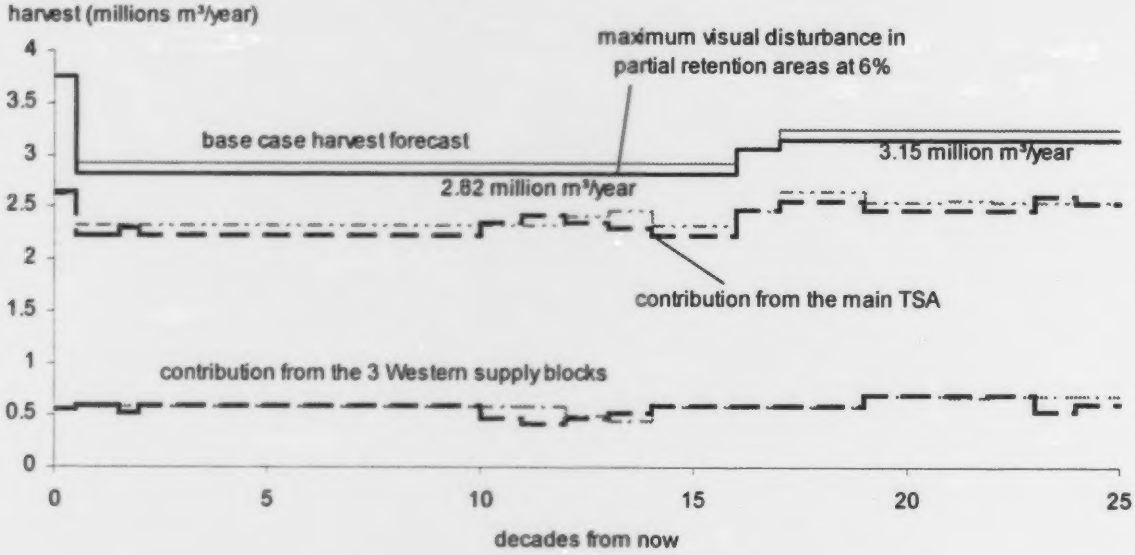

*Figure 22. Implications of reducing the maximum allowable disturbance in partial retention areas to 6% — Williams Lake TSA, 2001.*

## 5.6 Uncertainty in salvage operations and natural regeneration of low volume mountain pine beetle (MPB) attacked stands

Salvage of mountain pine beetle (MPB) attacked pine stands has been a prominent component of the AAC in the Williams Lake TSA since 1985. The purpose of this sensitivity analysis is to assess the contribution of low-volume mountain pine beetle attacked stands to the base case. Section A.4.6, "Mountain Pine Beetle (MPB) attacked pine stands," in Appendix A outlines the harvest and regeneration assumptions for low-volume mountain pine beetle attacked pine stands. Currently, almost 283 000 hectares of MPB-attacked stands which are at least 60 years of age are in the timber harvesting land base. Of this area, 156 301 hectares (55%) are low-volume MPB-attacked pine stands. For the base case, a total of 70 630 hectares were assumed to be eligible for salvage harvest over the first 5 years. The remaining 85 671 hectares have adequate site productivity to be eligible for inclusion in the timber harvesting land base, but have too little merchantable volume to be salvageable. The unsalvageable stands are assumed to regenerate naturally to a reduced natural pine stand yield table. The regenerated area listed here is less than the total area in Figure A-1 in Appendix A due to the provision for wildlife tree patches in the future. Attacked stands outside the timber harvesting land base are also assumed to regenerate naturally rather than aging indefinitely.

For this sensitivity analysis, low volume MPB-attacked stands are not salvaged, and there is no natural regeneration in any low volume stands. All attacked stands are assumed to continue aging from their current inventory age, but do not contribute to the timber harvesting land base. This area represents about 7% of the base case long-term timber harvesting land base. Figure 23 shows that the initial harvest level would decline to about 3.177 million cubic metres, about 17% below the current AAC. The medium-term harvest level would decline by about 3% while the long term would decline by about 5%. The medium-term implication is much less than the 7% timber harvesting land base contribution because the attacked stands possess about half of the volume of unattacked stands. The implication is greater in the long-term than the medium-term since in the base case the sites are assumed to be fully stocked after they are salvaged. However, even when fully stocked the low productivity pine stands in the IDF and SBPS are expected to produce less timber than the average site in the TSA; therefore the percentage timber supply impact is less than the land base reduction.

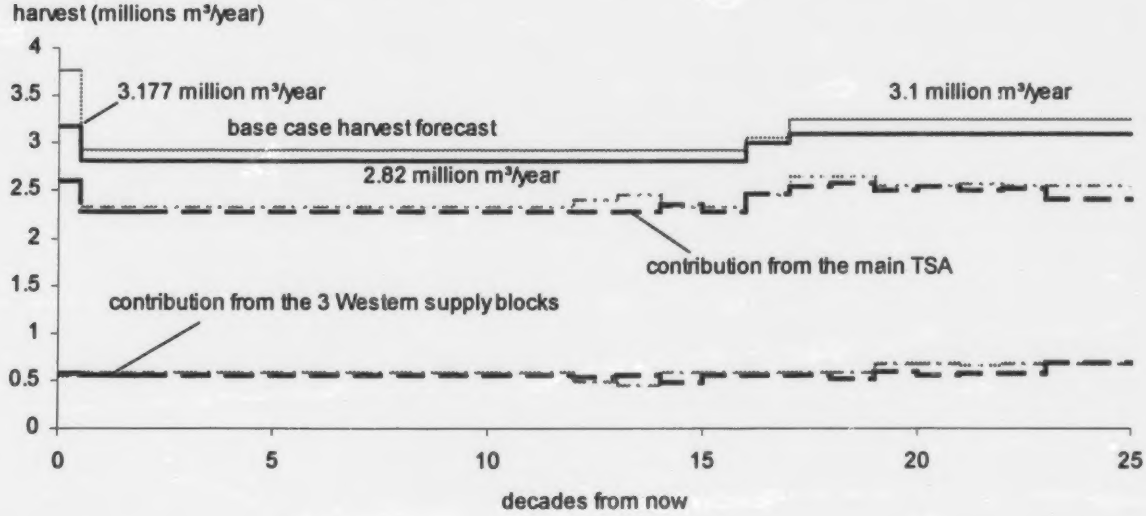

*Figure 23. Implications of eliminating salvage harvest and natural regeneration assumptions in mountain pine beetle (MPB) attacked pine stands — Williams Lake TSA, 2001.*

## 5.7 Uncertainty about disturbance in stands outside the timber harvesting land base

The current age class distribution (Figure 3) shows that the forest outside the timber harvesting land base in the Williams Lake TSA is well represented in all age categories. For the base case, while there is an accounting for stand losses on the timber harvesting land base and in MPB-attacked stands, it was assumed that most stands outside the timber harvesting land base would age indefinitely, that is, not be subject to disturbances that would replace the stand or alter it's age. (The exception is MPB-attacked pine stands that are given an explicit regeneration pathway.) The shortcomings of this assumption are recognized, but given a lack of local information on disturbance dynamics, this "no disturbance" assumption provides an upper boundary on the possible contribution of forest outside the timber harvesting land base to forest cover requirements.

To examine the implications of this assumption, a "deterministic" disturbance regime was applied to forest outside the timber harvesting land base to represent complete stand replacement. It is recognized that disturbances are to some extent random, in that they can occur at any time in many types of forest. Modelling of random events is time consuming and complex. To simplify analysis, a deterministic regime can be modelled, in which it is assumed that a disturbance of a specified nature will occur in specified types of forest, and will not occur otherwise. For this sensitivity analysis, it was assumed that any stand currently younger than 200 years of age outside the timber harvesting land base that reached the age of 250 years, would be disturbed and replaced with a new stand beginning with an age of zero. Stands outside the timber harvesting land base currently above 200 years of age were allowed to age indefinitely since they are likely to become part of old-growth management areas (OGMAs).

Figure 24 shows the timber supply implications of this disturbance regime. The timber supply would decline by three per cent in the medium- and long-term with most of the impact occurring in the main TSA. The reduction in supply would result because timber harvesting land base would be reserved to provide old forest for landscape-level biodiversity in some BEC variants.

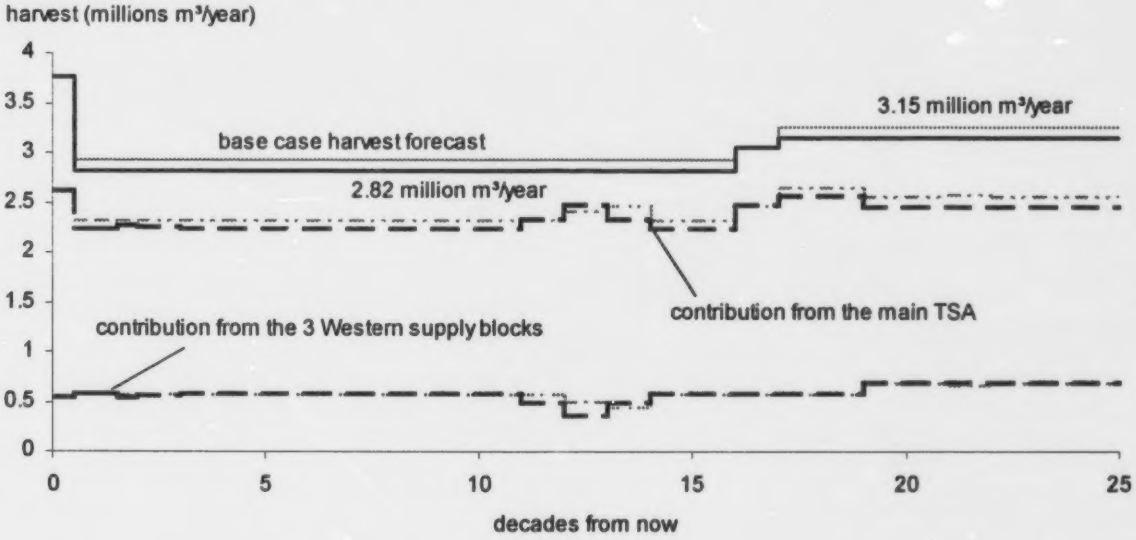

*Figure 24. Implications of stand replacing events outside the timber harvesting land base once stands reach 250 years of age — Williams Lake TSA, 2001.*

Figure 25 compares the projected age class distributions in 150 years time for the base case and for this sensitivity analysis. In the base case, about 67 000 hectares of timber harvesting land base is at least 250 years of age, and the entire forest outside the timber harvesting land base is at least 140 years of age. In this sensitivity analysis, almost 94 000 hectares of the timber harvesting land base is at least 250 years of age as additional timber harvesting land base is reserved to meet biodiversity requirements. Disturbance outside of the timber harvesting land base also results in a reduction in the harvest contribution from partial retention areas by about 2% relative to the base case.

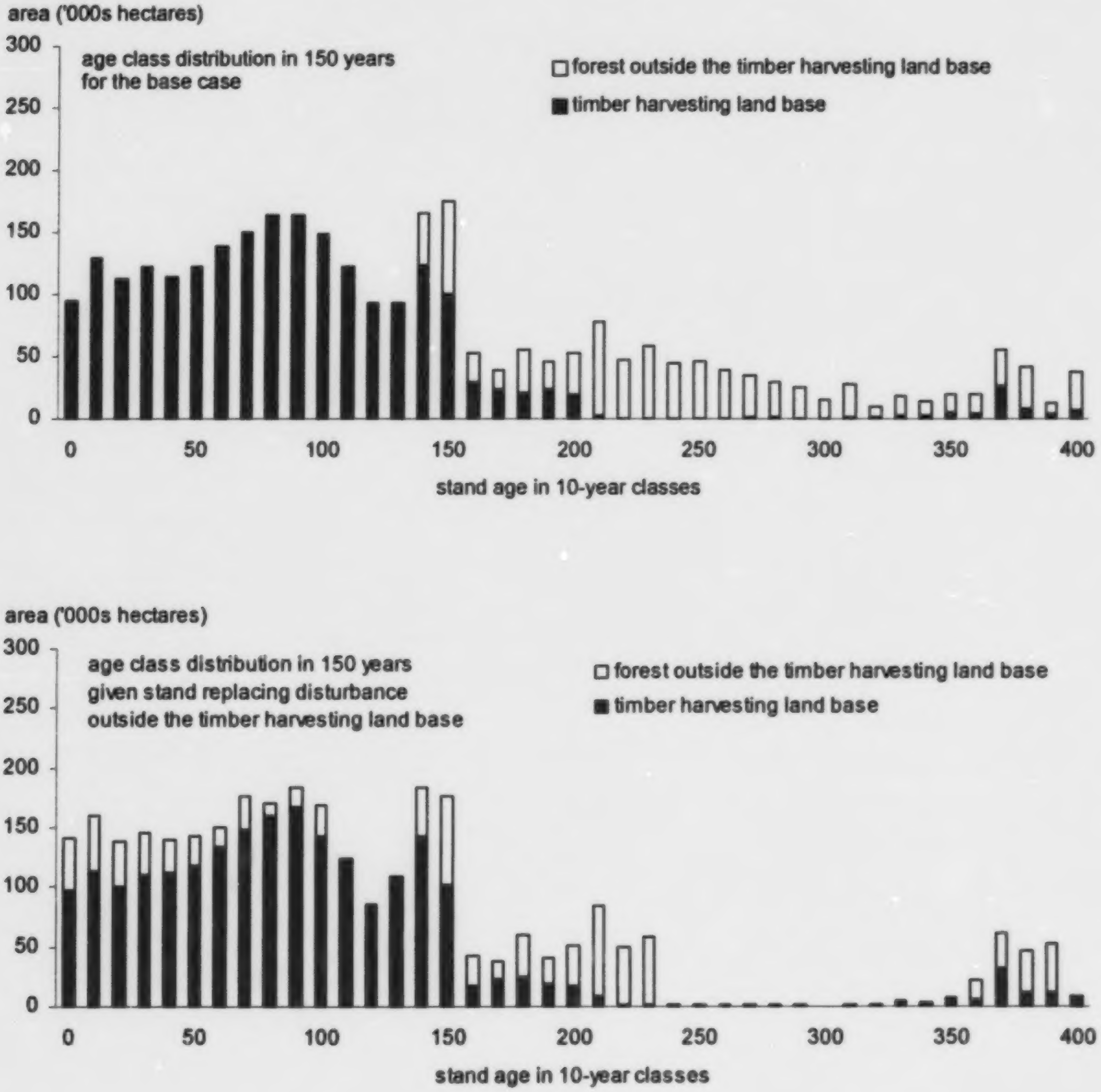

*Figure 25. Comparison of age class distributions in 150 years with and without (base case) disturbance outside of timber harvesting land base — Williams Lake TSA, 2001.*

## 5.8 Uncertainty in the site index assigned to stands above 140 years of age

The productivity of a site largely determines how quickly trees will grow. It therefore affects the timber volumes in regenerated stands, the time to reach green-up and the age at which stands are predicted to reach merchantable size. The most accurate estimates of site productivity come from stands between 30 and 150 years old. At ages less than about 30 years a temporary increase or decrease in growth due to factors such as a post-harvest flush of nutrients or an unusual drought year can affect the overall productivity estimated for the stand. At older ages, site productivity estimates may be incorrect because tree heights do not represent actual productivity — for example due to top breakage — and it is very difficult to determine ages of old trees accurately.

The results of province-wide research suggest that the estimated post-harvest productivity of sites currently occupied by old-growth stands may be significantly underestimated. Two *Old Growth Site Index* (OGSI) studies applicable to timber supply forecasting are:

- *Site index adjustments for old-growth stands based on paired plots* (British Columbia Ministry of Forests, Research Branch 1998b). Data were obtained from paired plots installed in old-growth stands and adjacent logged and regenerated stands of the same productivity. Site index (SI)* was estimated for both and comparisons were made. Results are available for lodgepole pine, interior spruce and coastal Douglas-fir.
- *Site index adjustments for old-growth stands based on veteran trees* (British Columbia Ministry of Forests, Research Branch 1998a). The objective of the study was to develop site index adjustments for species not covered by the paired-plot project. The data for this study came from temporary and permanent plots with a veteran and main stand component. The site indices for the two components were estimated and an adjustment equation for each species was derived using linear regression analysis. The results of the study are considered less reliable than those from the paired-plot study.

The results of these two studies apply only to stands currently older than 140 years that are expected to be clearcut, which comprise approximately 20% of the Williams Lake TSA timber harvesting land base. To test the sensitivity of the base case harvest forecast to uncertainty about site index estimates, site indices of these older stands were adjusted using first the paired plot information where applicable, or with veteran-tree results. Timber supply analysis inputs affected by changes in estimated future productivity (managed stand volume estimates, green-up ages and minimum harvestable age) were recalculated based on average site productivity. Table 7 compares the average forest inventory-based site index for each old-growth analysis unit for stands older than 140 years to those defined using the two OGSI adjustments. The average site index for the entire TSA timber harvesting land base was increased by two metres.

***Site index***
*A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground). Site index curves have been developed for British Columbia's major commercial tree species.*

*Table 7. Average area-weighted change in site index for stands over 140 years of age — Williams Lake TSA, 2001*

| Leading species | Area-weighted inventory site index | Area-weighted paired plot adjusted site index[1] | Area-weighted paired plot/veteran study site index | Timber harvesting land base (hectares) |
|---|---|---|---|---|
| Balsam | 10.8 | n.a. | 15 | 7 280 |
| Cedar | 15 | n.a. | 20.3 | 19 769 |
| Douglas-fir | 16.5 | n.a. | 18.4 | 12 085 |
| Hemlock | 13.2 | n.a. | 18.4 | 10 591 |
| Pine | 9.7 | 17 | 17.5 | 290 009 |
| Spruce | 11.7 | 19.7 | 19.7 | 83 740 |
| All | 10.7 | 17.2 | 18.1 | 423 474 |

Note: (1) Paired plot adjustments are applicable only to lodgepole pine and spruce. Therefore, in this column, site indexes for other all other species are not adjusted.

Figure 26 shows the timber supply implications of using only the paired plot adjusted site index for lodgepole pine and spruce stands over 140 years of age. The medium-term timber supply increases by 10% since managed stands are available earlier than in the base case, and the existing natural stand volume can be allocated for harvest over a shorter period of time. Many stands are available earlier than in the base case, which allows a rise to a higher long-term harvest level 26% higher than the base case a decade earlier. However, the long-term harvest level can only be maintained once all clearcut stands have been harvested and regenerated, and begun to grow according to managed stand yield predictions.

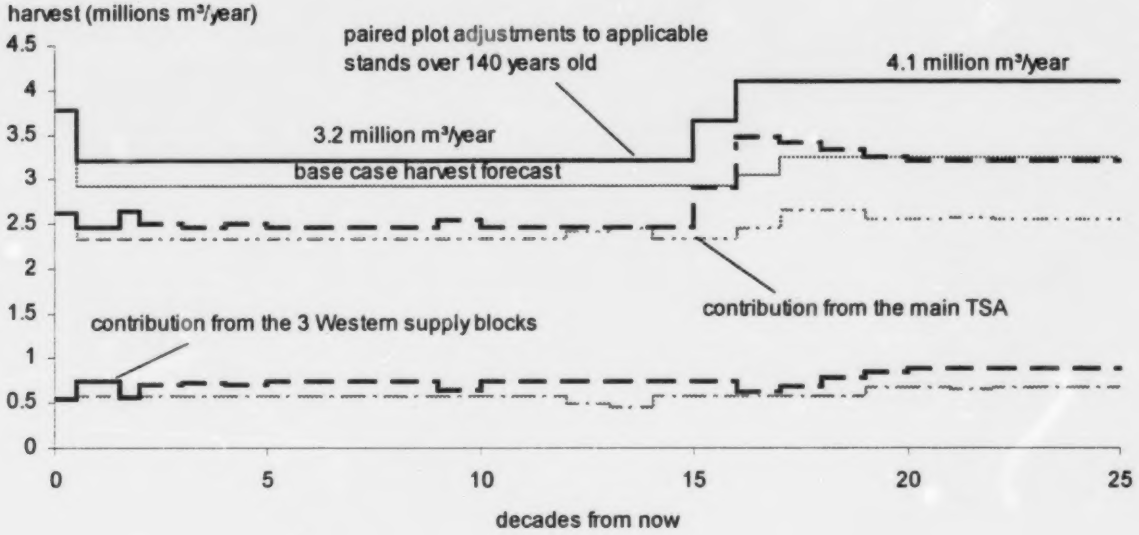

*Figure 26. Implications of site index adjustments for stands above 140 years of age and meeting the requirements based on the regional paired plot adjustment application guidelines — Williams Lake TSA, 2001.*

If the inventory site index values are adjusted by the paired plot adjustments where appropriate, and veteran study adjustments are applied to stands that do not have a paired plot adjustment, the timber supply is increased further over that shown in Figure 26. The long term would increase another 100 000 cubic metres per year to 4.3 million cubic metres per year.

## 5.9 Uncertainty with the harvest age profile

Given the spatial distribution of stands in the forest and other operational considerations, cutblocks will often cross several forest cover polygons of various ages, or younger stands may harvested as development proceeds through an area. In the base case, the relative-oldest first harvest priority was used. According to this rule, stands that are the oldest relative to their minimum harvestable age and that are not needed to achieve forest cover requirements receive the highest priority for harvest. In the Williams Lake TSA, this rule leads to a harvest blend of younger pine stands with older spruce stands. While this rule, in combination with applying forest cover requirements at the landscape unit level, has reduced the average harvest age since the previous TSR analysis, (TSR 1), the average for the base case in this analysis is still higher than experienced operationally. A summary of recent harvests in the Chilcotin Forest District showed that the harvest of 15 500 hectares had an area-weighted average harvest age of 135 years, compared to the projected base case average for the TSA of 195 years (Figure 15).

To broaden the profile or range of harvest ages, a more randomized harvest rule was developed for a sensitivity analysis. For the analysis, highest priorities were assigned to stands above the age of maximum average growth and above 100 years of age, but within those groups and for the remainder of the timber harvesting land base, harvest priority was random; that is, any stand had equal chance of being chosen for harvest. Such a restricted random priority provides a more realistic approach than a completely random harvest of any stand above minimum harvestable age since operators will generally favour higher volume older stands when possible. Forest development plans are not truly random but incorporate the systematic exploration of harvest opportunity in geographic areas. This sensitivity analysis provides some insight into the implications of having a wider age profile than modelled in the base case.

Figure 27 shows the timber supply implications of this randomized run. The medium-term harvest level is 8% below the base case while the long-term is 8% below the base case. The base case average area-weighted harvest age remains above 170 years for the first 50 years of modelling while the randomized run has an area-weighted average harvest age of 150 years of age for the first 50 years and for stands in multiple use areas over the same period the area-weighted average is about 140 years. This reduction in harvest age also results in a reduction in harvest volume per hectare. The base case showed an average volume per hectare harvested in the multiple use areas of about 200 cubic metres per hectare while the randomized run averages about 160 cubic metres per hectare over the 250-year analysis horizon.

Over the first 60 years in the base case, harvesting is projected to decline in the Horsefly Forest District while it increases in the Chilcotin Forest District (see Figure 10). In this sensitivity analysis, forest district harvesting levels are more stable. Williams Lake Forest District generally provides about 30% of the harvest, Horsefly provides another 30% and Chilcotin provides about 40% over the first 60 years. Despite the more random harvest, the timber supply in the western supply blocks remains relatively unchanged from the base case.

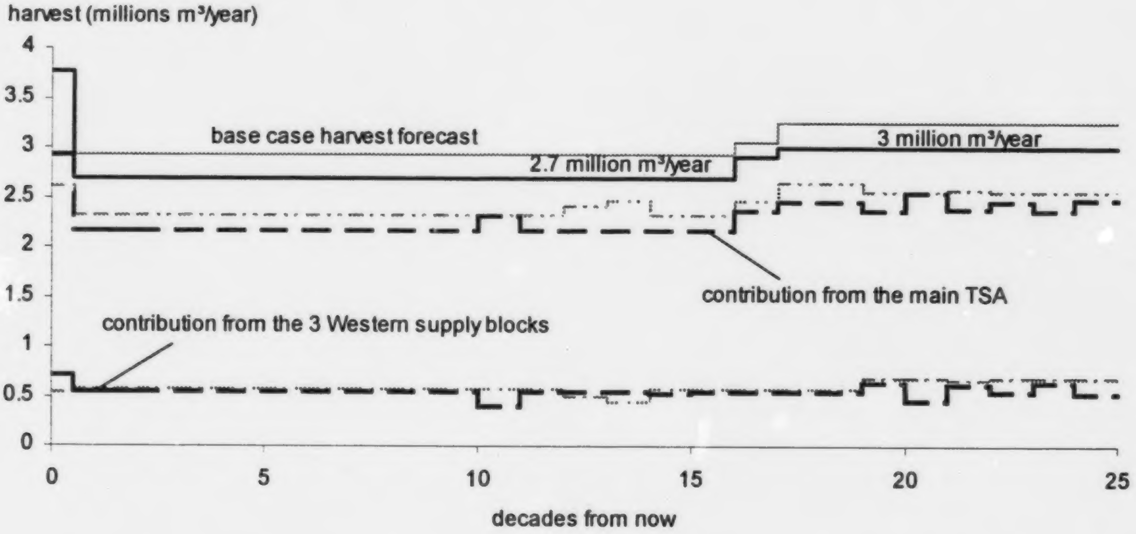

*Figure 27. Implications of a randomized harvest with a priority to stands above the age of maximum average growth then stands above 100 years of age — Williams Lake TSA, 2001.*

## 5.10 Uncertainty about the merchantable volume threshold used in defining the timber harvesting land base

The minimum merchantable requirements used in defining stands that contribute to the timber harvesting land base were based on actual harvesting summaries. However, there is some uncertainty that stands with volume as low as 65 cubic metres per hectare will consistently be harvested.

A sensitivity analysis was performed where the merchantable volume threshold was increased so that only sites capable of producing at least 100 cubic metres per hectare by 160 years of age would be in the timber harvesting land base. This change reduces the size of the timber harvesting land base, increases the minimum harvestable age and increases the estimates of timber yields given the removal of lower volume stands. The timber harvesting land base decreased by about 9% with one-third in stands with less than 80 cubic metres per hectare and two-thirds in stands with over 80 cubic metres per hectare and less than 100 cubic metres per hectare.

The timber supply implications of changing the minimum merchantability criteria are not proportional to the amount of land base removed since the productivity of the stands removed from the timber harvesting land base is well below the average for the Williams Lake TSA. Figure 28 shows that a 6% reduction in medium- and long-term timber supply would be experienced if a 100 cubic metre per hectare merchantability threshold were used. It is important to note that the minimum harvestable age for stands expected to be salvage harvested was not adjusted, but the amount of harvest was reduced to reflect that stands must be capable of producing 100 cubic metres per hectare by 160 years of age. The impact of the higher merchantability threshold is proportionally larger in the western supply blocks than in the main TSA, since the western supply blocks have a greater amount of lower productivity stands.

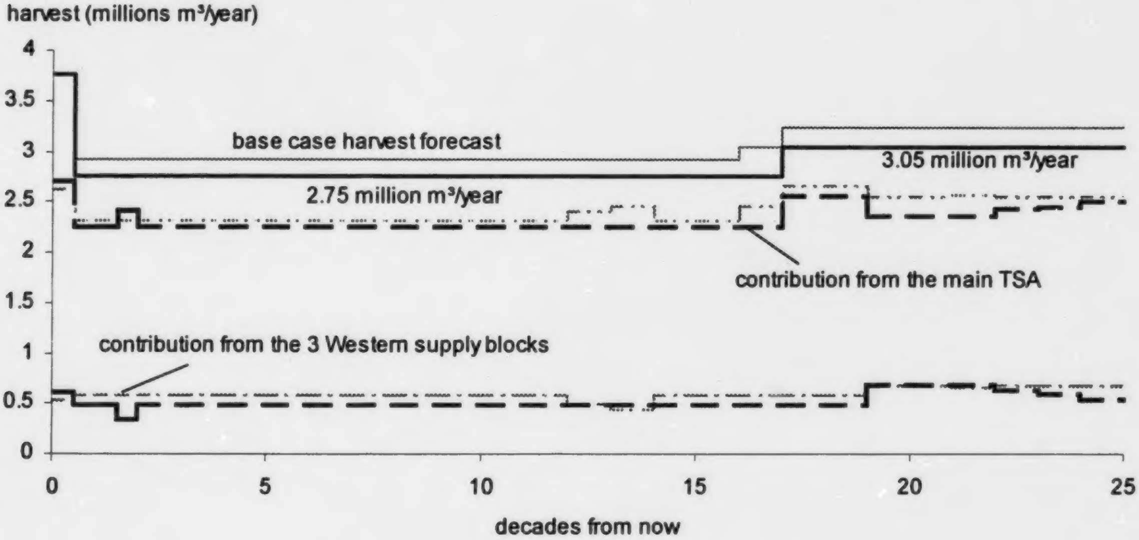

*Figure 28. Implications of raising the volume cut-off for minimum merchantability to 100 cubic metres per hectare — Williams Lake TSA, 2001.*

## 5.11 Differences in forest cover requirement description between TSR 1 and TSR 2

Since the last analysis performed for the Williams Lake TSA, modelling capability has expanded to allow more detailed representation of forest cover requirements. There are several differences in the application of forest cover requirements between the previous analysis and this one. In the previous analysis, stands could be placed in only one management emphasis zone even if multiple objectives applied to the area; forest cover requirements were applied to the timber harvesting land base; requirements for mature forest retention were applied to the timber harvesting land base in all areas; and requirements were applied over very broad areas (i.e., to the main TSA or the western supply blocks as a whole, rather than within a landscape unit). While cover requirements for some objectives were adjusted to account for the contribution from stands outside of the timber harvesting land base, as in the case of visual quality areas, forest outside the timber harvesting land base was not included explicitly in the TSR 1 analysis.

This sensitivity analysis provides some indication of the timber supply implications of a simpler data formulation similar to that used in TSR1. The forest cover requirements listed in Table 8 were applied in addition to the base case requirements.

*Table 8. Forest cover requirements based on TSR 1[1], Williams Lake TSA, 2001*

| Management emphasis | Maximum allowable disturbance (% area) less than green-up age | Green-up age | Minimum retention of older forest (% of area) | Minimum age | Application |
|---|---|---|---|---|---|
| Multiple use areas | 25 | 17 | 10 | 150 | Timber harvesting land base by main TSA or western supply blocks |
| Partial retention areas | 15 | 22 | 10 | 150 | Timber harvesting land base by main TSA or western supply blocks |
| CCLUP special management areas | 15 | 20 | 40 | 120 | Timber harvesting land base by main TSA or western supply blocks |

Note (1): These requirements are not exactly the same as those used in the TSR1 analysis. They were designed to reflect the general approach taken in that analysis, as discussed in the text of this section.

The intent in this sensitivity analysis was to avoid overlap among management zones for application of TSR 1-like requirements, but this was not always possible. The CCLUP special management area overlapped with the multiple use and partial retention areas since it was not practical to recreate the special management zones as used in the last analysis, and the current CCLUP special management areas were already created in the base case data set.

Figure 29 shows the timber supply implications of TSR 1-like cover requirements together with minimum harvestable age based on regional harvest age guidelines (as listed in Section 5.3.1, "Effect of minimum harvestable age based on regional harvest age guidelines"). Timber supply is reduced by 20% in the medium term and 9% in the long term. The additional requirements extend the harvest age in the special management areas and partial retention areas over the base case, and reduce the total amount of volume harvested over the modelling horizon. There is also a significant increase in the amount of timber harvesting land base retained in ages over 140 years over the long-term. In the base case, forest cover requirements resulted in about 19% of the timber harvesting land base being at least 140 years of age in 150 years, while 29% of the timber harvesting land base is above 140 years of age in this sensitivity analysis.

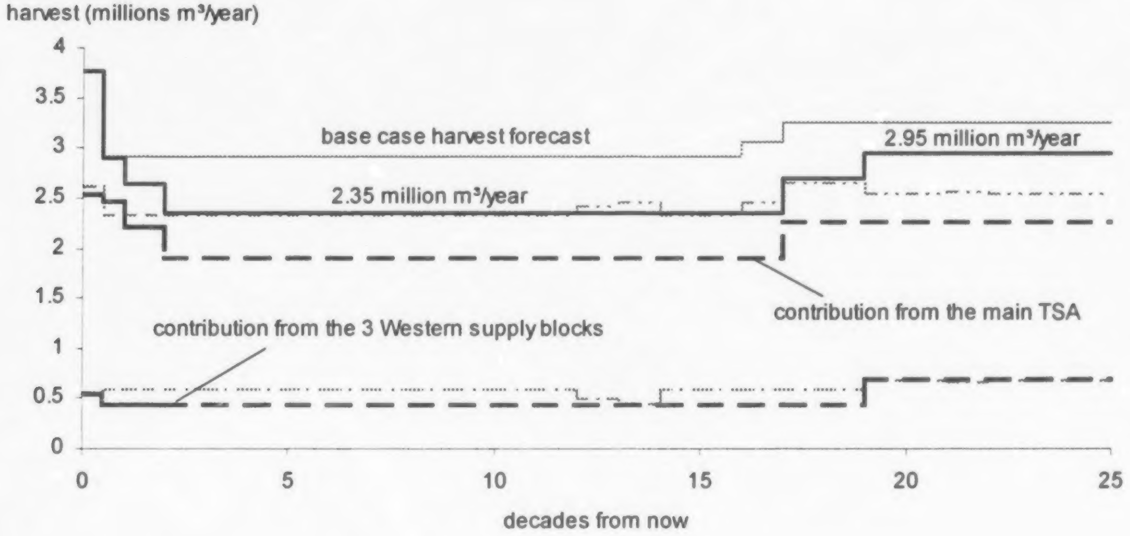

*Figure 29. Simplified representation of TSR 1 forest cover requirements — Williams Lake TSA, 2001.*

## 5.12 Combined effect of uncertainty in a number of factors

During preparation of the timber supply analysis, regional and district forest service staff highlighted several uncertainties that warranted further examination. To provide some insight into the possible interaction of some of these uncertainties, base case inputs related to four factors were changed for a sensitivity analysis:

- *Catastrophic stand replacing events in forest outside the timber harvesting land base.* Stands currently under the age of 200 years were assumed to regenerate to 0 years of age when they turn 250 years old (see Section 5.7).
- *Higher minimum volume threshold for defining merchantable stands*, to reflect the possibility that market conditions may not enable consistent harvesting of stands down to the minimum threshold used in the base case (65 cubic metres/hectare). Stands with less than 100 cubic metres per hectare were removed from the timber harvesting land base, and minimum harvestable ages were set to the age when 100 cubic metres per hectare has been attained (see Section 5.10).
- *Expanded harvest age profile.* A random harvest rule with priority to stands above 100 years of age was applied instead of relative oldest first (see Section 5.9).
- *Site index estimates for sites currently occupied by old-growth are known to be underestimated,* so 50% of current old-growth stands eligible for a paired plot site index adjustment were assumed to achieve the potential growth indicated by the higher site index. Given the uncertainty about whether full productivity will be met in regenerated stands, this approach was used to provide a conservative estimate of future growth potential.

Figure 30 shows the timber supply implications of these changes. The medium-term timber supply is 9% lower than the base case, while the long term is reduced by 6%. The changes to the base case assumptions reduce the land base, increase dependence on the timber harvesting land base for old forest representation, reduce harvest ages leading to volume increment losses, and increase long-term timber productivity. Compared to the base case, more than twice as much of the timber harvesting land base is projected to be older than 250 years of age in 150 years time. Also, the random harvest rule significantly reduces salvage harvest. This is a modelling artifact that could not be altered easily. The result is a significant loss of short-term volume and an extension in the time for the forest to reach a managed state, since stands that were salvage-harvested in the base case and regenerated to managed stands are instead regenerated naturally. If actual salvage harvests were modelled, the timber supply would be slightly higher over the analysis horizon compared to what is shown.

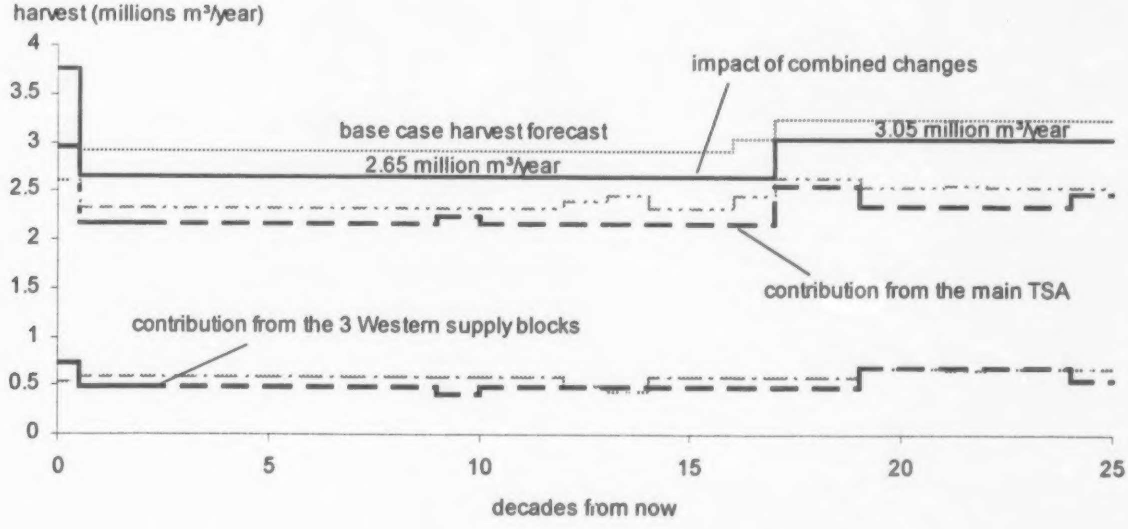

*Figure 30. Implications of the combined influence of a set of factors — Williams Lake TSA, 2001.*

# 6 Summary and Conclusions of the Timber Supply Analysis

The criteria used to define the base case harvest forecast included ending the salvage harvest in beetle-attacked timber in five years, finding the highest medium-term harvest level while maintaining a long-term harvest level reflective of the productivity of the timber harvesting land base and avoiding large and abrupt harvest shortfalls. An initial harvest level of 3.765 million cubic metres per year is maintained for 5 years, followed by a 22% decline to the medium-term harvest level of 2.92 million cubic metres per year. An 11% increase to the long-term harvest level of 3.25 million cubic metres per year occurs in decade 18. A correction to the volume adjustment factor for existing natural pine stands outside of the IDF/SBPS BEC zones (see Table A-1, "Volume adjustment factors for stands sixty years of age and older") increased medium-term timber supply by 80 000 cubic metres per year, with all of the increase occurring in the main TSA.

In the base case harvest forecast, existing natural stands provide most of the harvest for the next 60 years. Small amounts of existing natural forest are forecast to be harvested even 100 years from now when stands outside the timber harvesting land base age to the point that they are able to contribute to the biodiversity criteria associated with old forest. Selection or partial harvest generally contributes between 300 000 to 400 000 cubic metres per year. Within 70 years, harvesting of managed stands is anticipated to make up about 50% of the harvest in the Williams Lake TSA. By decade 14, this has increased to about 87%. However, a rise to the long-term harvest level cannot occur until a large proportion of managed stands are beyond minimum harvestable age and are closer to their maximum average growth rate.

The harvest rate between decades 12 and 18 determines the future long-term harvest level for the Williams Lake TSA. While a significant amount of managed stand volume is above minimum harvestable age during that time, the growth rates of these stands have not reached a level that can support the base case long-term harvest level. Attempting to rise to the long-term harvest level earlier than decade 18, or requesting a level such as the even-flow harvest level of 3.05 million cubic metres leads to harvesting stands closer to minimum harvestable age, resulting in a lower long-term harvest level. Harvests at minimum harvestable age would lead to a long-term harvest level of about 2.6 million cubic metres per year. Alternatively, the base case initial harvest level could be maintained for one decade before declining at a rate of about 9% per decade to a medium-term harvest level of 2.7 million cubic metres by decade five. The transition to the medium-term harvest level is less abrupt in this forecast than in the base case, but this forecast would be far more sensitive to changes in current management assumptions since the existing natural stand volume is allocated for harvest at a faster rate than in the base case.

To facilitate a summary of the sensitivity analyses, Table 9, "Summary information from the timber supply sensitivity analyses" was prepared to describe medium-term and long-term harvest levels. The first five years of harvest is held constant at 3.765 million cubic metres per year in all sensitivity analysis, except when salvage harvest was eliminated. The second five years is equivalent to the medium-term harvest level.

The current AAC is separated into four partitions. The partition of 107 000 cubic metres per year for the PA 16 area can be maintained for 30 years. A total of 850 000 cubic per year are partitioned to the salvage harvest of mountain pine beetle attacked stands, however, salvage harvesting is generally shown to be about 595 000 cubic metres per year in the analysis. This lower volume however, consists only of green (live) volume and does not include any dead trees that still have commercial value. The conventional harvest in the main TSA, which has a 2.5 million cubic metre partition, is projected to be 2.515 million cubic metres for the first five years of the forecast. In the western supply blocks, which are partitioned 350 000 cubic metres per years, the projected harvest over the first five years is 548 000 cubic metres per year.

The timber supply in the main TSA, where harvesting history is more extensive, tends to be more sensitive to changes in forest cover requirements than in the western supply blocks. Also broadening the age profile through a more random harvest rule reduces timber supply in the main TSA more so than in the western supply blocks. Conversely, timber supply in the western supply blocks tends to be more sensitive to uncertainty in the merchantability limits and site productivity, since the forests there generally have lower volume per hectare and lower site productivity than the main TSA.

# 6 Summary and Conclusions of the Timber Supply Analysis

*Table 9. Summary information from the timber supply sensitivity analyses*

| Section of report | Sensitivity analysis | Harvest components | Medium-term harvest level (millions of $m^3$/year)[a] | Long-term harvest level (millions of $m^3$/year)[b] |
|---|---|---|---|---|
| 4.1 | Base case harvest forecast. | TSA | 2.92 | 3.25 |
| | | Main | 2.33 | 2.56 |
| | | Western SB | 0.59 | 0.69 |
| 5.1 | Even-flow alternative harvest forecast. | TSA | 3.05 | 3.05 |
| | | Main | 2.36 | 2.47 |
| | | Western SB | 0.69 | 0.58 |
| 5.1 | Declining alternative harvest forecast. | TSA | 2.70 | 3.30 |
| | | Main | 2.16 | 2.67 |
| | | Western SB | 0.54 | 0.69 |
| 5.2 | Correction to the volume adjustment factor applied in the base case to pine stands outside of the IDF and SBPS BEC zones. | TSA | 3.00 | No change |
| | | Main | 2.41 | |
| | | Western SB | 0.59 | |
| 5.2 | Drawdown of the old requirement in enhanced and integrated resource management emphasis. | TSA | 2.94 | 3.25 |
| | | Main | 2.35 | 2.59 |
| | | Western SB | 0.59 | 0.66 |
| 5.3 | Regional harvest ages. | TSA | 2.82 | 3.10 |
| | | Main | 2.23 | 2.44 |
| | | Western SB | 0.59 | 0.66 |
| 5.3 | Increasing minimum harvestable age by 40 years. | TSA | No change | No change |
| | | Main | | |
| | | Western SB | | |
| 5.4 | Reduce the maximum allowable disturbance in multiple use areas to 18%. | TSA | No change | 3.14 |
| | | Main | | 2.50 |
| | | Western SB | | 0.64 |
| 5.5 | Reduce the maximum allowable disturbance in partial retention areas to 6%. | TSA | 2.82 | 3.15 |
| | | Main | 2.23 | 2.51 |
| | | Western SB | 0.59 | 0.64 |

*(continued)*

(a) The most common harvest level for the specific partition in the harvest forecast.

(b) The average harvest level over the long term for the specific partition.

# 6 Summary and Conclusions of the Timber Supply Analysis

*Table 9. Summary information from the timber supply sensitivity analyses (concluded)*

| Section of report | Sensitivity analysis | Harvest components | Medium-term harvest level (millions of $m^3$/year)[a] | Long-term harvest level (millions of $m^3$/year)[b] |
|---|---|---|---|---|
| 5.6 | Eliminate salvage operations and natural regeneration assumptions in low volume mountain pine beetle (MPB) attacked stands. | TSA<br>Main<br>Western SB | 2.82<br>2.27<br>0.55 | 3.10<br>2.5<br>0.60 |
| 5.7 | Regenerate stands outside the timber harvesting land base to simulate disturbance. | TSA<br>Main<br>Western SB | 2.82<br>2.23<br>0.59 | 3.15<br>2.49<br>0.66 |
| 5.8 | Adjustment of site index for stands above 140 years of age. | TSA<br>Main<br>Western SB | 3.20<br>2.46<br>0.74 | 4.10<br>3.26<br>0.84 |
| 5.9 | Broadening the harvest age profile through random harvest. | TSA<br>Main<br>Western SB | 2.70<br>2.16<br>0.54 | 3.00<br>2.44<br>0.56 |
| 5.10 | Increasing the minimum merchantable volume threshold to 100 cubic metres per hectare at 160 years. | TSA<br>Main<br>Western SB | 2.75<br>2.26<br>0.49 | 3.05<br>2.45<br>0.60 |
| 5.11 | Changes in forest cover requirement definition between TSR1 and TSR2. | TSA<br>Main<br>Western SB | 2.35<br>1.91<br>0.44 | 2.95<br>2.26<br>0.69 |
| 5.12 | Combined influence of a higher minimum merchantable volume threshold, disturbance of stands outside the timber harvesting land base, broadening the harvest age profile and including 50% of old stands regenerating with adjusted site index. | TSA<br>Main<br>Western SB | 2.65<br>2.16<br>0.49 | 3.05<br>2.36<br>0.62 |

(a) The most common harvest level for the specific partition in the harvest forecast.

(b) The average harvest level over the long term for the specific partition.

# 7 Socio-Economic Analysis

The impact of timber supply adjustments on local communities and the provincial economy is an important consideration in the timber supply review. This analysis examines the socio-economic implications of alternative harvest levels in the Williams Lake TSA. It compares the level of forestry activity currently supported by timber harvested from the Williams Lake TSA to the activity that could be supported by projected levels of timber supply in the Williams Lake TSA base case. The analysis uses the base case harvest forecast as an indication of future timber supply levels.

The socio-economic analysis includes:

- a profile of the current socio-economic setting;
- a description of the forest industry; and
- an analysis of the socio-economic implications of the base case harvest forecast.

The socio-economic analysis considers the current and projected levels of forestry activity associated with the Williams Lake TSA within the context of regional timber supplies and production capacity. The profile of the region and the local forest industry are described, and employment and income impacts associated with three main sectors—harvesting and other woodlands-related, processing, and silviculture—are estimated. Employment is measured in terms of person-years*. Employment income is calculated using average industry income estimates.

**Person-year(s)**
*One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years.*

Data on direct employment, harvest levels, and fibre flows were obtained by surveying licensees and mill operators. The information was used to estimate harvesting, processing and silviculture direct employment averages associated with the harvest, and the proportion of workers living in the area. The estimates of local and provincial harvesting, processing, and silviculture direct employment were then used to determine ratios of employment per 1000 cubic metres of timber harvested.

Indirect and induced employment were calculated using the employment multipliers* for the Williams Lake TSA and the province developed by the Ministry of Finance. Indirect impacts result from direct businesses purchasing goods and services; induced impacts result from direct employees purchasing goods and services. Employment coefficients* per 1000 cubic metres were also determined for these indirect and induced impacts.

To estimate the level of employment that could be supported by different harvest rates, projected timber supply levels were multiplied by the calculated employment coefficients. It should be noted that employment coefficients are based on current productivity, harvest practices and management assumptions and will not likely reflect industry conditions decades into the future. As such, the employment estimates should only be viewed in a general way.

**Employment multiplier**
*An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job.*

**Employment coefficient**
*The number of person-years of employment supported by every 1000 cubic metres of timber harvested; for example, a coefficient of 1.0 indicates that every 1000 cubic metres harvested supports one person-year, or 500 000 cubic metres supports 500 person-years.*

# 7 Socio-Economic Analysis

## 7.1 Current socio-economic setting

### 7.1.1 Population and demographic trends

The Williams Lake TSA is one of three TSAs in the Cariboo Forest Region, and includes the forest districts of Williams Lake, Horsefly and Chilcotin. It has a population of approximately 27,300 people (1996 census). The City of Williams Lake is the largest community in the TSA, with a population of about 10,500 people. Smaller communities include Alexis Creek and Anahim Lake in the west and Horsefly and Likely in the east. From 1991 to 1996, the population of the TSA increased 4%. In 2001, the population of the TSA is estimated to be more than 30,000, an increase of more than 10% from 1996 (see Table 10).

*Table 10. Population statistics — Williams Lake TSA*

| Communities | Population 1991 census | Population 1996 census | Estimated population 2001[a] | Per cent change 1996–2001 (%) |
|---|---|---|---|---|
| City of Williams Lake | 10,395 | 10,472 | 11,751 | 12.2 |
| Other communities in Williams Lake Forest District | 12,234 | 13,247 | 14,780 | 11.6 |
| Communities in Horsefly Forest District | 1,133 | 1,515 | 1,491 | – 1.6 |
| Communities in Chilcotin Forest District | 2,438 | 2,024 | 2,074 | 2.5 |
| Williams Lake TSA | 26,200 | 27,258 | 30,096 | 10.4 |

Sources: 1991 and 1996 census data. Between the 1991 and 1996 census, boundaries were changed for some enumeration areas. Population figures for some communities between the census may not be based on the same geographic area.

(a) Estimates are based on Local Health Area Population Projections. Data are from Population Section, British Columbia Statistics.

### 7.1.2 Economic profile

From 1991 to 1996, the experienced labour force in the Williams Lake TSA increased by 7% to 14,825. In comparison, the experienced labour force for the province increased by 12% over the same period. The unemployment rate in the Williams Lake TSA was 11.4% in 1996, compared with 13.3% in 1991. As Figure 31 illustrates, the major sources of employment in the Williams Lake TSA are forestry, the public sector (which includes education, health, and federal, provincial and local public services), and tourism. Figures from the 1996 census indicate that the forestry sector accounted for more than 30% of employment (direct, indirect and induced) in the TSA.

Tourism, which includes portions of several service sectors including accommodation services, retail trade and transportation, has demonstrated significant growth and investment in recent years. Nearly 2,000 persons are employed in the Williams Lake TSA's tourism sector, catering to both tourist and business travellers. More than 500 businesses in the Williams Lake TSA service visitors' needs, including outdoor recreation facilities, tours and attractions, retail and service businesses, food and beverage facilities, and accommodations.

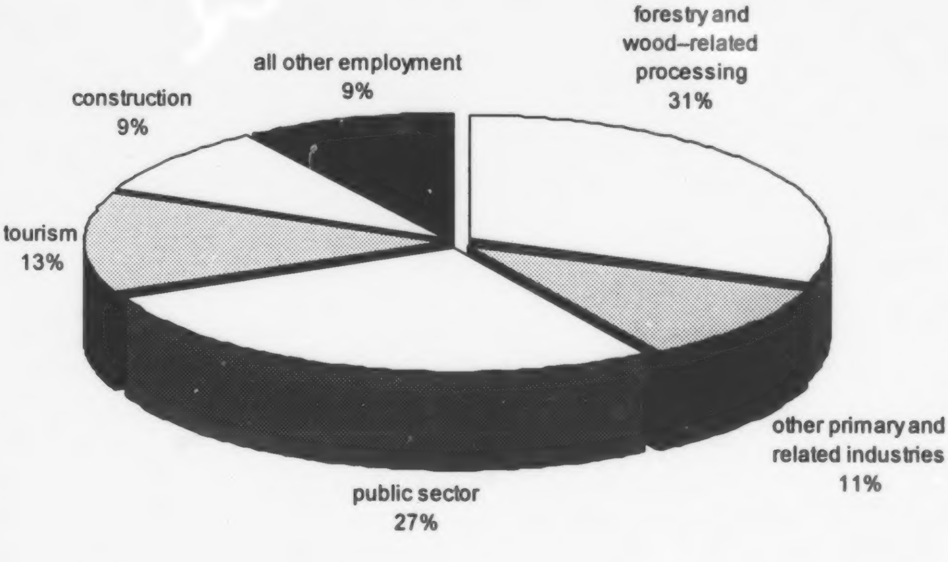

*Figure 31. Estimates of employment by sector — Williams Lake TSA, 1996.*

Source: 1996 census.

# 7 Socio-Economic Analysis

Income, whether business or personal, is another indicator of a sector's contribution to the economy. Each job in a sector with high income levels tends to support more indirect and induced* employment than do jobs in sectors with lower income levels. Statistics Canada labour force data, comparing average weekly earnings in different sectors of the economy, indicate that the forestry sector is one of the highest paying sectors and, therefore, a major contributor to the local and provincial economies. Mining is the only sector that has consistently paid higher wages than forestry. In 2000, the average weekly earnings (before income taxes) in the forestry sector were about $963, compared with $1,167 for the mining sector. In other sectors, average weekly earnings were $736 for the construction industry; $341 for the accommodation, food and beverage services industries[1]; and $814 for the public sector.

Employment multipliers reflect the income effect: the greater the multiplier, the greater the impact that each job in this sector has on the economy. For example, research indicates that every 100 full-time direct forestry jobs in the Williams Lake TSA supports another 12-58 indirect and induced jobs, depending on the forestry activity (harvesting or timber processing). In comparison, for every 100 full-time direct jobs in the tourism sector, an estimated additional 3-20 indirect and induced jobs are supported. The differences are due to greater spending patterns by both forestry sector businesses and their employees. Table 11 compares estimated employment, average weekly earnings and employment multipliers for selected industry sectors of the Williams Lake TSA.

*Table 11. Average weekly earnings and employment multipliers — Williams Lake TSA*

| Industry sector | 2000 average weekly earnings ($) | Employment multiplier[a] |
|---|---|---|
| Forestry and related | 963 | 1.12–1.58 |
| Mining and related | 1,167 | 1.17–1.88 |
| Construction | 736 | 1.18–1.54 |
| Tourism | 341 | 1.03–1.20 |
| Public sector | 814 | 1.07–1.34 |

Sources: Statistics Canada. 2000. Estimates of average weekly earnings. Weekly earnings are before income taxes.

Ministry of Finance and Corporate Relations. 1999. The 1996 Forest District Tables. Refers to 1996 census data.

(a) Includes direct, indirect and induced jobs.

***Indirect and induced jobs***
*Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets.*

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(1) In British Columbia, the average weekly earnings for those in the tourism sector ranges from $244 for food service workers to $356 for hotel workers. In 2000, there were more than four times the number of workers in food services than in hotels, motels and trailer courts services in the province. The average weekly earnings in the tourism sector reflect, therefore, the larger portion of workers who have the lower average weekly earnings.

## 7.2 Description of the forest industry

### 7.2.1 Current allowable annual cut

The current allowable annual cut (AAC) of 3 807 000 cubic metres was established in 1996. Replaceable and non-replaceable forest licences account for more than 80% of the apportioned volume in the TSA, and the Ministry of Forests' Small Business Forest Enterprise Program (SBFEP) accounts for about 14% of the apportioned volume. Table 12 indicates the current apportioned AAC by type of licence.

*Table 12. Allowable annual cut apportionment — Williams Lake TSA, 1996*

| Type of licence | Volume ($m^3$) | Per cent (%) |
|---|---|---|
| Forest licences, replaceable | 2 055 793 | 54 |
| Forest licences, non-replaceable | 1 011 454 | 27 |
| Timber Sale Licence (TSL) < 10 000 $m^3$, replaceable | 10 760 | < 1 |
| Pulpwood agreement | 107 000 | 3 |
| Small Business Forest Enterprise Program (SBFEP) | 544 720 | 14 |
| Woodlot licences | 56 096 | 1 |
| Forest Service Reserve | 21 177 | < 1 |
| Total | 3 807 000 | 100.0 |

Source: Ministry of Forests. Resource Tenures and Engineering Branch.

### 7.2.2 Recent harvest history

The actual annual harvest level is an important indicator of forestry activity in the TSA. While the AAC is the maximum allowable annual harvest level, the actual volume of timber harvested in a particular year determines the level of economic activity.[2] If actual annual harvest levels are less than the AAC, then economic activity is also less than that which could be attained if the full AAC were harvested. A persistent gap between the AAC and the actual annual harvest level could influence the potential short-term impacts of changes in the AAC. Table 13 summarizes the volume of timber harvested in the Williams Lake TSA from 1996 to 2000.

*Table 13. AAC and volume billed, by licence type — Williams Lake TSA, 1996-2000*

| | Cubic metres (m³) | | | | | |
|---|---|---|---|---|---|---|
| **Type of licence[a]** | **1996** | **1997** | **1998** | **1999** | **2000** | **Average 1996–2000** |
| Forest licence | 3 340 023 | 2 396 763 | 2 993 857 | 3 409 784 | 3 098 067 | 3 047 699 |
| Small Business Forest Enterprise Program (SBFEP) | 433 587 | 849 589 | 533 636 | 428 166 | 526 121 | 554 220 |
| Other[b] | 94 674 | 60 116 | 64 223 | 75 005 | 178 890 | 94 582 |
| Total | 3 868 284 | 3 306 468 | 3 591 716 | 3 912 955 | 3 803 079 | 3 696 500 |
| Allowable annual cut | 3 807 000 | 3 807 000 | 3 807 000 | 3 807 000 | 3 807 000 | |

Source: Ministry of Forests, Harvest Database.

(a) Timber harvested from private lands and woodlots is not included in this analysis. Average annual harvest from private lands for the same period was 80 471 cubic metres and from woodlots was 41 951 cubic metres.

(b) Other includes rights-of-way clearing, roads, trespass and other miscellaneous harvests.

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(2) Cut-control permits licensees to vary the volume between annual harvest and AAC by 50% per year and by 10% over a five-year period. This variability gives licensees the flexibility to adapt to changing conditions, including changing markets.

### 7.2.3 Major licensees and processing facilities

**Ainsworth Lumber Co. Ltd.**

Ainsworth Lumber Co. Ltd. (Ainsworth) has a pulpwood agreement to harvest a maximum of 107 000 cubic metres per year of pulpwood within the Williams Lake TSA. Harvest in recent years has averaged less than 24 000 cubic metres per year. About 75% of the volume from this harvest is processed outside the TSA. Based on averages of other licensees and operators in the TSA, Ainsworth's harvest from this licence supported an estimated 16-19 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 14). All workers associated with the harvesting and processing of the timber from this licence live outside the Williams Lake TSA.

*Table 14. Ainsworth's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 107 000 cubic metres |
| Average annual harvest (1997-1999) | 23 066 cubic metres |
| 1999 harvest | 6 493 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 3-4 |
| Log transport | 1-2 |
| Road construction and maintenance | < 1 |
| Silviculture | 1 |
| Timber processing | 11-12 |
| Total | 16-19 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1997-1999 average annual harvest of 23 066 cubic metres. Estimates are derived from information supplied by the licensees in the TSA and include employment associated with TSA timber that is processed outside the TSA.

**Dagish Enterprises Ltd.**

Dagish Enterprises Ltd. (Dagish) has a non-replaceable forest licence to harvest 50 000 cubic metres per year. Although a very small volume (less than 300 cubic metres) in the licence was harvested in 1999, full-scale harvesting under this licence did not begin until 2000. An estimated 80% of the harvested timber from this licence is processed within the TSA. Based on averages of licensees and operators in the TSA, Dagish's 2000 harvest under this licence supported an estimated 50 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 15). An estimated 80% of the workers associated with the harvesting and processing of the timber from this licence live in the Williams Lake TSA.

*Table 15. Dagish's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 50 000 cubic metres |
| Average annual harvest (1999-2000) | 30 455 cubic metres |
| 2000 harvest | 60 674 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 11 |
| Log transport | 4 |
| Road construction and maintenance | 2 |
| Silviculture | 2 |
| Timber processing | 31 |
| Total | 50 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 2000 harvest of 60 674 cubic metres. Estimates are derived from information supplied by the licensee in the TSA and include employment associated with TSA timber that is processed outside the TSA.

**Jackpine Forest Products Ltd.**

Jackpine Forest Products Ltd. (Jackpine) has a non-replaceable forest licence to harvest 60 000 cubic metres per year. All the volume harvested from this licence is processed at a lumber mill located within the Williams Lake TSA. Based on recent data, Jackpine's average annual harvest from this licence supported an estimated 15-18 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 16). About 70% of the workers associated with the harvesting and processing of the timber from this licence live in the Williams Lake TSA.

*Table 16. Jackpine's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 60 000 cubic metres |
| Average annual harvest (1999-2000) | 32 470 cubic metres |
| 2000 harvest | 28 024 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 6-7 |
| Log transport | < 1 |
| Road construction and maintenance | < 1 |
| Silviculture | 0 |
| Timber processing | 8-10 |
| Total | 15–18 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1999-2000 average annual harvest of 32 470 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed outside the TSA.

**Alvin Johnson**

Alvin Johnson has a replaceable timber sale licence to harvest 2058 cubic metres per year. Between 1998 and 2000, average annual harvests from this licence have been 2344 cubic metres. Based on averages of licensees and operators in the TSA, the average annual harvest from this licence supported an estimated two person-years of employment in harvesting, silviculture, timber processing and related activities.

**Lignum Limited**

Lignum Limited (Lignum) has a replaceable forest licence and a non-replaceable forest licence to harvest 491 416 cubic metres per year. Almost all the harvest from the two licences is processed at the company's lumber mill in Williams Lake. Based on recent data, Lignum's average annual harvest from this licence supported an estimated 398-486 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 17). Almost all workers associated with the harvesting and processing of the timber from these licences reside in the Williams Lake TSA.

*Table 17. Lignum's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 491 416 cubic metres |
| Average annual harvest (1998-2000) | 601 076 cubic metres |
| 2000 harvest | 544 217 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 94-122 |
| Log transport | 36-43 |
| Road construction and maintenance | 6-8 |
| Silviculture | 30-45 |
| Timber processing | 232-268 |
| Total | 398-486 |

Source: Ministry of Forests, Harvest Database

(a) Estimates of employment are based on 1998-2000 average annual harvest of 601 076 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed outside the TSA.

**Linde Bros. Lumber Ltd.**

Linde Bros. Lumber Ltd. (Linde Bros.) has a replaceable timber sale licence to harvest 8702 cubic metres per year. All the timber harvested from this licence is processed in the company's lumber mill in Williams Lake TSA. Based on averages for other licensees and operators in the TSA, the average annual harvest from this licence supported an estimated 4-6 person-years of employment in harvesting, silviculture, timber processing and related activities. Almost all the workers associated with the harvesting and processing of the timber from this licence live in the Williams Lake TSA.

# 7 Socio-Economic Analysis

**Riverside Forest Products Limited**

Riverside Forest Products Limited (Riverside) and its subsidiary company, RFP Timber Ltd. have three replaceable forest licences and two non-replaceable forest licences to harvest 1 130 321 cubic metres per year. About 95% of the harvest from these licences is processed at the company's two lumber mills in Williams Lake. Based on recent data, Riverside's average annual harvest from these licences supported an estimated 843-1,040 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 18). Nearly 85% of the workers associated with the harvesting and processing of the timber from these licences live in the Williams Lake TSA.

*Table 18. Riverside's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 1 130 321 cubic metres |
| Average annual harvest (1998-2000) | 1 159 765 cubic metres |
| 2000 harvest | 1 184 213 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 143–160 |
| Log transport | 58–64 |
| Road construction and maintenance | 19–25 |
| Silviculture | 60–80 |
| Timber processing | 563–711 |
| Total | 843–1,040 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1998–2000 average annual harvest of 1 159 765 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed outside the TSA.

# 7 Socio-Economic Analysis

**Tsi Del Del Enterprises Ltd.**

Tsi Del Del Enterprises Ltd. (Tsi Del) has a non-replaceable forest licence to harvest 60 000 cubic metres per year. All the harvested timber from this licence is processed at lumber and chip mills located within the TSA. Based on recent data, Tsi Del's average annual harvest from this licence supported an estimated 65–73 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 19). About 85% of the workers associated with the harvesting and processing of the timber from this licence live in the Williams Lake TSA.

*Table 19. Tsi Del's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 60 000 cubic metres |
| Average annual harvest (1998-2000) | 76 379 cubic metres |
| 2000 harvest | 71 227 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 17–20 |
| Log transport | 9–10 |
| Road construction and maintenance | 3 |
| Silviculture | < 1 |
| Timber processing | 35–39 |
| Total | 65–73 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1998–2000 average annual harvest of 76 379 cubic metres. Estimates are derived from information supplied by the licensee.

# 7 Socio-Economic Analysis

**Tsilhqot'in Forest Products Inc.**

Tsilhqot'in Forest Products Inc. (Tsilhqot'in) has a non-replaceable forest licence to harvest 65 000 cubic metres per year. Average annual harvest from this licence in recent years has been 17 982 cubic metres. All the harvested timber from this licence is processed within the TSA. Based on averages of licensees and operators in the TSA, Tsilhqot'in's average annual harvest from this licence supported an estimated 11-15 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 20). About 80% of the workers associated with the harvesting and processing of the timber from this licence live in the Williams Lake TSA.

*Table 20. Tsilhqot'in's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 65 000 cubic metres |
| Average annual harvest (1999–2000) | 17 982 cubic metres |
| 2000 harvest | 12 507 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 2-4 |
| Log transport | 1-2 |
| Road construction and maintenance | 1 |
| Silviculture | 1 |
| Timber processing | 6-12 |
| Total | 11-20 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1999-2000 average annual harvest of 17 982 cubic metres. Estimates are derived from information supplied by the licensee.

**Weldwood of Canada Ltd.**

Weldwood of Canada Ltd. (Weldwood) has a replaceable forest licence to harvest 504 602 cubic metres per year. About 45% of the timber harvested from this licence is processed in the company's plywood in Williams Lake. The remaining 55% is processed at the company's lumber mill in 100 Mile House. Based on recent data, Weldwood's average annual harvest from this licence supported an estimated 506-603 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 21). About 70% of the workers associated with the harvesting and processing of the timber from this licence live in the Williams Lake TSA.

*Table 21. Weldwood's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 504 602 cubic metres |
| Average annual harvest (1998-2000) | 568 798 cubic metres |
| 2000 harvest | 484 584 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 62–78 |
| Log transport | 25–35 |
| Road construction and maintenance | 10 |
| Silviculture | 14–15 |
| Timber processing | 395–465 |
| Total | 506–603 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1998–2000 average annual harvest of 568 798 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed outside the TSA.

**West Fraser Mills Ltd.**

West Fraser Mills Ltd. (West Fraser) has two replaceable forest licence and a non-replaceable forest licence to harvest 404 454 cubic metres per year. Almost 90% of the timber harvested from these licences is processed in the company's lumber mill in Williams Lake. Based on recent data, West Fraser's average annual harvest from these licences supported an estimated 279-341 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 22). Nearly 85% of the workers associated with the harvesting and processing of the timber from these licences live in the Williams Lake TSA.

*Table 22. West Fraser's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 404 454 cubic metres |
| Average annual harvest (1998–2000) | 370 411 cubic metres |
| 2000 harvest | 381 361 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 90–107 |
| Log transport | 31–43 |
| Road construction and maintenance | 13–14 |
| Silviculture | 13–25 |
| Timber processing | 129–152 |
| Total | 276–341 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1998–2000 average annual harvest of 370 411 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed outside the TSA.

# 7 Socio-Economic Analysis

**Yun Ka Whu'ten Holdings Ltd.**

Yun Ka Whu'ten Holdings Ltd. (Yun Ka) has two non-replaceable forest licences to harvest 240 000 cubic metres per year. All the harvest from the two licences is processed at the company's lumber mill in Anahim Lake. Based on recent data, Yun Ka's average annual harvest from these licences supported an estimated 100-117 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 23). Almost all the workers associated with the harvesting and processing of the timber from this licence reside in the Williams Lake TSA.

*Table 23. Yun Ka's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut | 240 000 m³ |
| Average annual harvest (1998–2000) | 173 727 m³ |
| 2000 Harvest | 41 846 |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 22–24 |
| Log transport | 9–11 |
| Road construction and maintenance | 10–12 |
| Silviculture | 9–11 |
| Timber processing | 50–59 |
| Total | 100–117 |

Source: Ministry of Forests, Harvest Data Base.

[a] Estimates of employment are based on 1998–2000 average annual harvest of 173 727 cubic metres. Estimates are derived from information supplied by the licensee.

# 7 Socio-Economic Analysis

### Small Business Forest Enterprise Program (SBFEP)

The apportioned volume in Williams Lake TSA's SBFEP is 544 720 cubic metres per year, or about 14% of the TSA's apportioned AAC. SBFEP harvests in recent years have averaged about 496 000 cubic metres per year, or about 13% of the total annual harvest in the TSA. Based on averages of licensees and operators in the TSA, an estimated 80% of the timber harvested in the SBFEP is processed within the TSA. The volume harvested under the SBFEP supported an estimated 353-440 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 24). SBFEP Registrants who reside within the Williams Lake TSA accounted for an estimated 80% of the SBFEP timber harvest in the TSA.

*Table 24. SBFEP's harvest and direct employment statistics*

| | |
|---|---|
| Allowable annual cut (AAC) | 544 720 cubic metres |
| Average annual harvest (1998–2000) | 495 974 cubic metres |
| 2000 harvest | 526 121 cubic metres |
| Estimated employment (person-years)[a] | |
| Harvesting and administration | 76-95 |
| Log transport | 31-38 |
| Road construction and maintenance | 11-13 |
| Silviculture | 16-20 |
| Timber processing | 219-274 |
| Total | 353-440 |

Source: Ministry of Forests, Harvest Database.

(a) Estimates of employment are based on 1998–2000 annual average harvest of 495 974 cubic metres. Estimates are derived from industry averages of licensees and operators in the TSA and include employment associated with TSA timber that is processed outside the TSA.

# 7 Socio-Economic Analysis

### Williams Lake TSA timber supply and processing capacity

About 90% of the timber harvested in the Williams Lake TSA is processed within the TSA. Timber processing plants in the Williams Lake TSA include nine lumber mills, three log home builders, one veneer/plywood mill and two chip mills. These timber processing plants have an estimated annual processing capacity of almost 4.0 million cubic metres. (Table 25) Between 1998 and 2000, harvests in the TSA averaged 3 769 250 cubic metres per year. Since some of the harvest in the TSA is transported out of the TSA to be processed, additional timber supply for processing plants in the TSA comes from nearby TSAs and private sources.

*Table 25. Timber processing facilities and estimated annual capacities — Williams Lake TSA, 2000*

| Name | Type of mill | Location of mill | Estimated annual capacity ('000s m³) |
|---|---|---|---|
| Chimney Creek Lumber Co. | Lumber | Williams Lake | 5 |
| Jaco Enterprises Ltd. | Chip | Williams Lake | 140 |
| Lignum Ltd. | Lumber | Williams Lake | 935 |
| Linde Bros. Lumber Ltd. | Lumber | Williams Lake | 10 |
| Pioneer Log Homes Ltd. | Log home | Williams Lake | 15 |
| R. Durfeld Log Construction | Log home | Williams Lake | 1 |
| RFP Timber Ltd. | Chip | Williams Lake | 65 |
| RFP Timber Ltd. Soda Creek Division | Lumber | Williams Lake | 440 |
| RFP Timber Ltd. Williams Lake Division | Lumber | Williams Lake | 840 |
| Sigurdson Brothers Logging Ltd. | Lumber | Alexis Creek | 30 |
| Weldwood of Canada Ltd. | Veneer/plywood | Williams Lake | 360 |
| West Chilcotin Forest Products Ltd. | Lumber | Nimpo Lake | 480 |
| West Chilcotin Log Crafters Ltd. | Log home | Anahim Lake | 10 |
| West Fraser Mills Ltd. | Lumber | Williams Lake | 615 |
| Wildwood Forest Products Ltd. | Lumber | Williams Lake | 5 |
| Total | | | 3 951 |

Sources: Ministry of Forests. Major primary timber processing facilities in British Columbia, 2000.

Capacity estimates for lumber and chip mills are based on 480 eight-hour shifts per year or log input, whichever is higher.

Capacity estimate for veneer/plywood mill is based on 480 (veneer) and 720 (plywood) eight-hour shifts per year, or log input, whichever is higher.

Capacity estimates for log home builders are based on 240 workings days per year, or log input, whichever is higher.

Additional information provided by operators in TSA.

### 7.2.4 Forestry sector employment and employment coefficients

Harvesting and employment information is used to estimate employment coefficients which are used to project future employment levels in the forestry sector. For this purpose, the forestry sector has been divided into three sub-sectors:

- harvesting and other woodlands-related employment such as log transportation, log salvage, log scaling and harvest planning and administration;
- silviculture employment such as planting, surveying and other basic and intensive silviculture activities, such as spacing, fertilization and pruning*; and
- primary timber processing employment, such as manufacturing activities at lumber mills, veneer and plywood mills, shake and shingle mills and pulp and paper mills.

**Harvesting employment**

The harvesting employment component is closely related to the volume that is harvested and is, therefore, the first sub-sector affected by changes in the TSA's harvest level. This sub-sector includes employees who work in the harvesting operations of a forest company as well as contract loggers. Harvesting activity in the Williams Lake TSA occurs mostly from June to February. Feller-buncher and grapple-skidder are the main types of harvesting methods used.

**Silviculture employment**

The silviculture employment component is not as closely related to the AAC because time can elapse between when harvesting ends and when replanting the harvested areas begins.[3] Basic silviculture consists of surveys, site preparation, planting, brushing, cone collection and spacing. Enhanced silviculture includes spacing, fertilization and pruning. In the Williams Lake TSA, licensees are responsible for basic silviculture on areas harvested under major licences. The provincial government is responsible for all enhanced silviculture and the remaining basic silviculture on Crown land.

**Primary timber processing employment**

The timber harvested from the Williams Lake TSA is processed into a variety of products such as lumber, panel products, log homes, poles and posts, shakes and shingles, and pulp at mills within the TSA and in neighbouring TSAs. Mills in the TSA also process timber that is harvested from other TSAs and private sources.

**Ministry of Forests employment**

The Williams Lake TSA encompasses three forest districts — Williams Lake, Chilcotin and Horsefly. In all, about 150 people work in these district offices. The Cariboo Forest Region's office is also located with the Williams Lake TSA. Approximately 95 people work in the regional office and support activities in three TSAs — Williams Lake, 100 Mile House and Quesnel. Regional and district staffs oversee the management of forestry-related activities on Crown land in the Williams Lake TSA. Employment in the Ministry of Forests is not included as part of direct employment in the forestry sector because its activities are more related to administration and enforcement of government policy than to the harvest level, and would not be affected by marginal changes in the timber supply. Ministry employees are, nevertheless, an important part of total employment in the TSA and are accounted for in the government services component of the TSA's economic base.

***Pruning***
*The manual removal of the lower branches of crop trees to a predetermined height to produce clear, knot-free wood.*

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(3) In addition to replanting the harvested area, there are requirements to ensure the re-established stand reaches first green-up, and then a free-growing state. The time that it takes for a regenerated area to reach green-up state varies, depending on the requirements for visual, hydrological and wildlife resource values. The height requirement for regenerated stands can vary among different resource zones. The time required for the regenerated stands to reach the free-to-grow state (when the planted commercial species are as high or higher than competing non-commercial species or brush vegetation) varies according to the silvicultural system used and the ecological association of the stand. Experience indicates that this period can range from 7 to 20 years after harvest. Silviculture activity in harvested areas continues until the stand reaches the free-growing state.

### Employment coefficients

Employment coefficients, expressed as person-years of employment per 1000 cubic metres of harvest, have been calculated using employment information from licensees and operators. Table 26 summarizes employment supported by the 1998-2000 harvests in the Williams Lake TSA and the corresponding employment coefficients. The employment and coefficients are separated into two groups:

1. TSA employment and employment coefficients, which comprise residents of the Williams Lake TSA who are employed in the forestry sector within the Williams Lake TSA; and
2. Provincial employment and employment coefficients, which comprise all forestry sector employment in the province that relies on the Williams Lake TSA timber supply, including both residents of the Williams Lake TSA and those who live elsewhere.

Calculations have been made for both groups to identify the importance of the forestry sector within the Williams Lake TSA and to highlight the contribution of the Williams Lake TSAs forestry sector to the provincial economy. Employment is divided into direct, indirect and induced components; the sum of the components is the total impact, expressed as the number of full-time jobs per 1000 cubic metres of timber harvested or processed. Indirect and induced employment figures were derived using employment multipliers developed by the Ministry of Finance.

The 1995 *Williams Lake Timber Supply Area Socio-Economic Analysis* reported that the average annual harvest of 3.35 million cubic metres supported an estimated 2,714 person-years of direct forestry employment in the province. This result indicated a provincial employment coefficient of 0.81 person-years of direct employment per 1000 cubic metres.

The current timber supply review shows that harvesting, silviculture and timber processing activities associated with Williams Lake TSA's 1998–2000 average annual harvest of about 3.77 million cubic metres supported an estimated 3,040 person-years of direct employment in the province. This outcome again indicates a provincial employment coefficient of 0.81 person-years of direct employment per 1000 cubic metres[4] (Table 26). For a more detailed discussion regarding employment coefficients, see Appendix B, "Socio-Economic Analysis Background Information."

*Table 26. Forestry sector employment and employment coefficients — Williams Lake TSA*

| | Within TSA | | Province | |
|---|---|---|---|---|
| **Activity** | **TSA employment (person-years)[a]** | **TSA employment coefficient (person-years per '000s $m^3$)** | **Province employment (person-years)[a]** | **Province employment coefficient (person-years per '000s $m^3$)** |
| Harvesting | 837 | 0.22 | 848 | 0.22 |
| Silviculture | 122 | 0.03 | 187 | 0.05 |
| Timber processing | 1,460 | 0.39 | 2,005 | 0.53 |
| **Total direct employment** | **2,419** | **0.64** | **3,040** | **0.81** |
| Indirect + induced employment | 1,317 | 0.35 | 4,065 | 1.08 |
| **Total** | **3,736** | **0.99** | **7,105** | **1.89** |

(a) Employment estimates are reported in person-years (PY) and are based on 1998–2000 average employment and harvest of 3 765 250 cubic metres in the Williams Lake TSA. Due to rounding, some totals may not equal the sum of their components.

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(4) Differences in employment coefficient ratios can be due to several reasons: (1) different sources of information; (2) different methods of calculation; (3) reference to employment at different harvest levels; (4) different definitions of full-time employment; and (5) different definitions of forestry sub-sectors. Regardless of which definitions are used, the resulting estimates of impacts of harvest level changes should illustrate similar effects.

### 7.2.5 Forestry sector employment income

Between 1998-2000, the average annual income of forestry employees was $47,100 for those working in logging and forestry services; $44,900 for those working in solid wood manufacturing; and $56,400 for those working in pulp and paper mills. For workers in indirect and induced employment (such as construction, business services, retail trade, etc.), the estimated average annual income was $30,800. Based on 1998–2000 annual averages, the Williams Lake TSA timber harvest generated about $143.48 million in direct employment income and an additional $125.20 million of indirect and induced employment income. In all, the harvest generated an estimated total of $268.68 million in employment income, or more than $71,200 per 1000 cubic metres harvested (Table 27).

*Table 27. Estimate of forestry sector provincial employment income — Williams Lake TSA*

| Employment component | Estimated person-years of employment | Estimated annual income per worker ($) | Total employment income ($ million) | Employment income[a] ($ per '000s m$^3$) |
|---|---|---|---|---|
| Direct employment | | | | |
| Logging and forestry services | 1,035 | 47,100 | 48.75 | 12,933 |
| Solid wood processing | 1,596 | 44,900 | 71.66 | 19,012 |
| Pulp and paper processing | 409 | 56,400 | 23.07 | 6,120 |
| Subtotal (direct employment) | 3,040 | | 143.48 | 38,065 |
| Indirect + induced employment | 4,065 | 30,800 | 125.20 | 33,217 |
| **Total** | **7,105** | | **268.68** | **71,282** |

Source: Statistics Canada. Survey of employment, payroll and hours. 1998 to 2000 data.

(a) Estimates based on 1998–2000 average annual harvest of 3 769 250 cubic metres. Due to rounding, some totals may not equal the sum of their components.

### 7.2.6 Provincial government revenues

The provincial government receives taxes and revenues from the forest industry. The forest industry pays stumpage, royalties and rent to the provincial government for the right to harvest and use timber. The forest industry also pays operating taxes such as logging, corporate income, property and sales taxes. As well, the provincial and federal governments receive revenues from forestry employees through income taxes.

Between 1998 and 2000, the timber harvest in the Williams Lake TSA contributed about $51.02 million in stumpage and rent payments annually to the provincial government. Other taxes paid by the forest industry, such as logging, corporate income, property and sales taxes, contributed about $29.14 million annually. In addition, the provincial government received about $23 million in income taxes paid by forestry sector employees (Table 28). Altogether, the timber harvest in the Williams Lake TSA contributed an estimated $103.13 million to provincial government revenues.

*Table 28. Estimate of average annual provincial revenues, 1998–2000 — Williams Lake TSA*

| Provincial revenues from: | Average annual volume harvested ($m^3$) | Average annual provincial revenues ($ million) | Average annual provincial revenue ($ per '000s $m^3$) |
|---|---|---|---|
| Stumpage and related revenues[a] | 3 769 250 | 51.02 | 13,535 |
| Forest industry taxes[b] | 3 769 250 | 29.14 | 7,731 |
| Employment income taxes[c] | 3 769 250 | 22.97 | 6,093 |
| Total | 3 769 250 | 103.13 | 27,359 |

(a) Source: Ministry of Forests, Revenue Branch.

(b) Based on estimates by PriceWaterhouseCoopers, and includes taxes for logging, corporate income, corporate capital, sales, property and electricity.

(c) Estimated from Canada Customs and Revenue Agency. Income tax includes only the provincial share of income taxes paid.

## 7.3 Implications of the base case harvest forecast

The socio-economic analysis focuses on harvest level changes in the short- to medium-term of 10-30 years from now and considers:

- the implications of alternative harvest levels for both the Williams Lake TSA and the province;
- possible impacts on the communities within the TSA;
- log supply requirements of timber processing facilities within the Williams Lake TSA; and
- regional timber supply implications.

The socio-economic analysis considers average levels of forestry activity that the base case harvest forecast could support, assuming that the current role of the forestry sector in the provincial economy continues and that labour productivity does not change. The analysis also assumes that the proportions of harvesting, silviculture and timber processing employment remain constant and that the types and portions of wood products manufactured remain the same.

Possible employment impacts associated with future harvest levels are calculated using employment coefficients (person-years of employment per 1000 cubic metres). This method of calculating employment coefficients assumes that employment levels in the future can be predicted using current conditions of employment and the volume of timber harvested or processed. While this method can be reasonably accurate for short-term forecasts (within the next 3–5 years), employment coefficients 20 years from now may be very different, due, for example, to changes in forest products market conditions and timber processing technologies. The analysis estimates the size of impacts on employment, employment income and provincial government revenues, within a constantly changing socio-economic environment.

**The base case harvest forecast for the Williams Lake TSA**

In the base case, harvests over the first five years are forecast to be 3 765 000 cubic metres per year, which is 42 000 cubic metres, or about 1.1% less than the current AAC. From year six onward, the base case harvest forecast is 2 920 000 cubic metres per year, a decline of about 23% from the current AAC.

### 7.3.1 Employment and employment income impacts within the Williams Lake TSA

Using 1998-2000 annual averages, the base case harvest forecast of 3 765 000 cubic metres per year for the first five years could support an estimated 3,731 person-years of employment (direct, indirect and induced) in the TSA, which is almost the same as current levels. Employment income generated in the Williams Lake TSA is estimated to be $151.15 million.

From year six onwards, the base case harvest forest of 2 920 000 cubic metres per year could support an estimated 2,894 person-years of employment (direct, indirect and induced) in the TSA, or about 23% less than current levels. Employment income generated in the TSA at that harvest level is estimated to be $117.23 million.

### 7.3.2 Employment and employment income impacts in the province

Provincial employment includes all forestry sector employment supported by the timber harvested from the Williams Lake TSA. The base case harvest forecast for the next five years could support an estimated 7,097 person-years of employment in the province and generate an estimated $268.36 million in employment income. The base case harvest forecast for year six and beyond could support an estimated 5,504 person-years of employment and generate an estimated $208.13 million in employment income (Table 30).

### 7.3.3 Provincial government revenues

Provincial government revenues from the harvest of the current AAC are estimated to be $104.43 million annually. The base case harvest forecast of 3 765 000 cubic metres per year for the first five years, about 1% less than the current AAC, could generate, on average, an estimated $103.28 million annually in provincial government revenues. Assuming no changes to tax rates or to stumpage-related charges and provided that the entire volume is harvested and fully utilized, annual provincial government revenues could be about $1 million less than the current amount. From year six onwards, the base case harvest forecast of 2 920 000 cubic metres per year, could generate an estimated $80.09 million annually in provincial government revenues. This amount is about $24 million less than the current level.

Under the current AAC in the Williams Lake TSA, 850 000 cubic metres per year, or about 22% is attributable to the salvage of timber damaged by the mountain pine beetle. The salvage program began in 1985 and is expected to end within the next few years. During these years, stumpage revenue generated by the timber harvest in the TSA included the portion collected from the harvest of the damaged timber for which a reduced stumpage rate was charged.

If, as expected, the salvage of beetle-damaged timber will be completed within the next five years, then beginning in year six, all volume harvested in the TSA would be charged the full stumpage rate. In this situation, and based on recent years' weighted average stumpage rates for the TSA, stumpage revenues for year six and beyond would increase to an estimated $54.23 million (from $39.52 million) per year. That is, instead of generating $80.09 million per year in provincial revenues (stumpage revenues, forest industry taxes and employment income taxes), the amount calculated based on the average stumpage rate over the last few years, the base case harvest forecast for year six and beyond could generate an estimated $94.80 million per year in provincial revenues (see Table 29). This level is about $10 million less than the current amount, but about $15 million more than projected given the average stumpage that includes the reduced rate charged for salvaged timber.

The extent to which such changes in the average stumpage rate will occur will depend on the progress of the current beetle infestation in the region.

*Table 29. Comparison of estimated provincial revenues — beetle damaged versus non-damaged timber*

| Revenue source: | Base case<br>mid-term harvest level (year 6 and beyond) | Weighted average stumpage rate<br>(damaged timber) $13.535 per m³ | <br>(non-damaged timber) $18.572 per m³ |
|---|---|---|---|
| | | ($ million) | |
| Stumpage and related revenues | 2 920 000 m³ | 39.52 | 54.23 |
| Forest industry taxes | 2 920 000 m³ | 22.78 | 22.78 |
| Employment income taxes | 2 920 000 m³ | 17.79 | 17.79 |
| Total | | 80.09 | 94.80 |

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### 7.3.4 Community impacts

The impacts of short- and long-term changes in timber supply will be much greater on an economy that depends heavily on the local timber supply than on one that is more diversified. The base case harvest forecast indicates that the timber supply may decrease by 42 000 cubic metres, or 1.1% less than the current AAC over the next five years, and by 887 000 cubic metres, or 23% from the current AAC in year six onward.

### 7.3.5 Log supply requirements of timber processing facilities in the Williams Lake TSA

Between 1998 and 2000, harvests in the Williams Lake TSA averaged 3 769 250 cubic metres per year. Nearly 90% of the timber was processed within the TSA. The estimated timber processing capacity in the Williams Lake TSA is almost 4.0 million cubic metres per year. Additional timber supplies are procured from nearby TSAs and private sources.

### 7.3.6 Regional timber supply issues

The movement of timber across forest district boundaries means that communities in the Williams Lake TSA can be vulnerable to timber supply changes in other districts. Information from previous timber supply reviews indicated that the timber supply in the three TSAs of the Cariboo Forest Region could decline by about 15% or almost 1.1 million cubic metres by the year 2017[5], with the largest decrease, in both percentage and volume, in the Williams Lake TSA. However, the more recent analyses for the ongoing Timber Supply Review suggest the regional timber supply may be somewhat more stable. This outlook may change as each successive timber supply review re-examines the timber supply in the region. How these processes may eventually impact the Williams Lake TSA will depend on the actual timber supply changes, the composition of the industry and timber flows at the time.

On June 22, 2001 the Chief Forester announced an AAC increase of over 900 000 cubic metres for the Quesnel TSA. The AAC increase is necessary to help salvage damage from and control the mountain pine beetle epidemic in the region. Harvesting and processing of this additional wood is expected to offset to some degree the impacts of declines in mountain pine beetle salvage in the Williams Lake TSA.

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(5) These estimates are based on the most previous timber supply review base case forecasts for Williams Lake, Quesnel and 100 Mile House TSAs. The combined timber supply volume for these management units is currently 7.51 million cubic metres per year. The harvest level is forecast to be 6.43 million cubic metres per year by 2017.

*Table 30. Socio-economic impacts of Williams Lake TSA base case harvest forecast*

| | | **Base case harvest forecast** | |
|---|---|---|---|
| | **Current AAC**[a] | **Next five years** | **Year six and beyond** |
| Harvesting activity | | ('000s m³) | |
| Current AAC/forecast timber supply | 3 807.0 | 3 765.0 | 2 920.0 |
| Harvest level (1998–2000 average) | 3 769.3 | | |
| Difference from current AAC | – 37.7 | – 42.0 | – 887.0 |
| **Williams Lake Timber Supply Area** | | | |
| Employment | | (person-years) | |
| Direct | 2,443 | 2,416 | 1,874 |
| Indirect + induced | 1,330 | 1,315 | 1,020 |
| Total | 3,773 | 3,731 | 2,894 |
| Range of employment gain[b] or (loss) | | (42) | (879) |
| Employment income | | ($ millions) | |
| Direct | 111.88 | 110.64 | 85.81 |
| Indirect + induced | 40.96 | 40.51 | 31.42 |
| Total | 152.84 | 151.15 | 117.23 |
| Range of income gain (loss) compared with AAC | | (1.69) | (35.61) |
| **Province**[c] (including Williams Lake TSA) | | | |
| Employment | | (person-years) | |
| Direct | 3,070 | 3,037 | 2,355 |
| Indirect + induced | 4,106 | 4,060 | 3,149 |
| Total | 7,176 | 7,097 | 5,504 |
| Range of employment gain or (loss) | | (79) | (1,672) |
| Employment income | | ($ millions) | |
| Direct | 144.91 | 143.31 | 111.14 |
| Indirect + induced | 126.45 | 125.05 | 96.99 |
| Total | 271.36 | 268.36 | 208.13 |
| Range of income gain (loss) compared with AAC | | (3.00) | (63.23) |
| **Provincial government revenues** | | ($ millions) | |
| Stumpage and related payments | 51.53 | 50.96 | 39.52 |
| Forest industry taxes | 29.70 | 29.38 | 22.78 |
| Employee income taxes | 23.20 | 22.94 | 17.79 |
| Total | 104.43 | 103.28 | 80.09 |
| Gain (reduction) in revenues compared to current AAC | | (1.15) | (24.34) |

(a) Estimates of employment and income in this table differ from those in Tables 27–28. Employment estimates in this table are based on the current AAC of 3 807 000 cubic metres, while the estimates in Tables 27–28 are based on the 1998–2000 average annual harvest volume of 3 769 250 cubic metres. Due to rounding, some totals may not equal the sum of their components.

(b) The ranges for employment and income changes consider employment insurance and other social assistance programs that give temporary short-term income to unemployed or displaced workers. The range's upper limit assumes that all those who are unemployed or displaced will leave the TSA to seek opportunities elsewhere and will no longer spend their income locally, thus imparting a higher impact on the local economy than if they had not left. The range's lower limit assumes that employment insurance and other social assistance payments to unemployed or displaced workers will temporarily encourage them not to leave the community, thus reducing the induced impacts of a lower harvest level. The actual impacts of changes in harvest levels on employment and incomes will likely fall within the specified ranges. See Appendix B for additional explanations.

(c) Estimates of TSA employment and income impacts are included as part of the estimates of provincial employment and income impacts.

## 7.4 Summary

Forestry is the major resource sector in the Williams Lake TSA economy, although in the western portion of the TSA, agriculture and ranching are important resource sectors. Major forest licence holders in the TSA include Ainsworth Lumber Co. Ltd.; Dagish Enterprises Ltd.; Jackpine Forest Products Ltd.; Lignum Limited; Riverside Forest Products Limited and its subsidiary company, RFP Timber Ltd.; Weldwood of Canada Limited; West Fraser Mills Ltd.; Yun Ka Whut'ten Holdings Ltd. Together, these licensees account for nearly 85% of the apportioned volume in the TSA. The Ministry of Forests Small Business Forest Enterprise Program (SBFEP) accounts for an additional 14% of the apportioned volume. Timber processing plants in the Williams Lake TSA include nine lumber mills, three log home builders, one veneer/plywood mill and two chip mills.

Over the first five years of the base case timber supply forecast for the Williams Lake TSA, the projected harvest level is 3 765 000 cubic metres per years, or 1.1% less than the current allowable annual cut of 3 807 000 cubic metres. (It should be noted that the AACs attributable to woodlot licenses issued since the last determination for the TSA amount to 23 600 cubic metres. Therefore, the portion of the current AAC attributable to the TSA is 3 783 400 cubic metres, and the base case projection over the first five years is only about 0.5% less than this level.). From year six and beyond, the projected supply is 2 920 000 cubic metres per year.

The initial level of harvest projected in the base case could support an estimated 7,097 person-years of forestry employment (includes direct, indirect and induced jobs) and generate $268.36 million of employment income in the province. An estimated $103.28 million per year in provincial government revenues could also be generated. Within the Williams Lake TSA, the volume from the base case harvest forecast could support an estimated 3,731 person-years of employment annually and generate an estimated $151.15 million in employment income.

From year six and beyond, the level of harvest activity could support an estimated 5,504 person-years of forestry employment and generate more than $80.0 million per year in provincial government revenues. It is expected that the remainder of the timber damaged by mountain pine beetle attack in the TSA will be harvested within the next few years. If this occurs, beginning in year six, all volume harvested in the TSA will be charged the full stumpage rate. In this situation, and based on recent years' weighted average stumpage rates for undamaged timber in the TSA, stumpage revenues for year six and beyond will increase to an estimated $54.23 million per year. That is, instead of generating $80.09 million per year in provincial revenues (stumpage revenues, forest industry taxes and employment income taxes), the base case harvest forecast for year six and beyond could generate an estimated $94.80 million per year in provincial revenues, which is about $10 million less than the current amount, but almost $15 million more than if a stumpage rate based on partly on salvage harvest is used. The extent to which such changes in the average stumpage may occur will depend on the progress of the current beetle infestation in the region.

The recent AAC increase in the Quesnel TSA to address the mountain pine beetle epidemic is expected to help offset the employment and income impacts of the decline in salvage harvests in the Williams Lake TSA.

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# 9 Glossary

| | |
|---|---|
| **Allowable annual cut (AAC)** | The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood per year. |
| **Analysis unit** | A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables. |
| **Base case harvest forecast** | The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis. |
| **Biodiversity (biological diversity)** | The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them. |
| **Biogeoclimatic (BEC) variant** | A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone. |
| **Biogeoclimatic zones** | A large geographic area with broadly homogeneous climate and similar dominant tree species. |
| **Clearcut harvesting** | A harvesting method in which all trees are removed from an area of land in a single harvest. The harvested site is then regenerated to acceptable standards by appropriate means including planting and natural seeding. Note that retention of some live trees and snags for purposes of biodiversity now occurs on most clearcuts. |
| **Culmination age** | The age at which a timber stand reaches its highest average growth rate, or mean annual increment (MAI). MAI is calculated as stand volume divided by stand age. Culmination age is the optimal biological rotation age to maximize long-term volume production from a growing site. |
| **Cutblock** | A specific area, with defined boundaries, authorized for harvest. |
| **Cutblock adjacency** | The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions. |

# 9 Glossary

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| **Deciduous** | Deciduous trees shed their leaves annually and commonly have broad-leaves. |
| **Employment coefficient** | The number of person-years of employment supported by every 1000 cubic metres of timber harvested; for example, a coefficient of 1.0 indicates that every 1000 cubic metres harvested supports one person-year, or 500 000 cubic metres supports 500 person-years. |
| **Employment multiplier** | An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job. |
| **Environmentally sensitive areas** | Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches. |
| **Forest inventory** | An assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of other forest values such as recreation and visual quality. |
| **Forest Practices Code** | Legislation, standards and guidebooks that govern forest practices and planning, with a focus on ensuring management for all forest values. |
| **Forest type** | The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples. |
| **Free-growing** | An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition. |
| **Green-up** | The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas. |
| **Growing stock** | The volume estimate for all standing timber at a particular time. |

# 9 Glossary

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| **Harvest forecast** | The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized over time for a specified land base and set of management practices. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions. |
| **Harvest rule** | The method used to create a harvest order for stands above minimum harvestable age. Rules like absolute-oldest first(ranking by oldest age), relative-oldest first(ranking by oldest age relative to a stand's minimum harvestable age), youngest first, random harvest are commonly used. |
| **Higher level plans** | Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area. |
| **Indirect and induced jobs** | Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets. |
| **Integrated resource management (IRM)** | The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making. |
| **Landscape-level biodiversity** | The *Landscape Unit Planning Guide* provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity. |
| **Landscape unit** | A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives. |
| **Long-term harvest level** | A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield. |
| **Management assumptions** | Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs. |

# 9 Glossary

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| **Model** | An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities. |
| **Not satisfactorily restocked (NSR) areas** | An area not covered by a sufficient number of well-spaced tree stems of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR. |
| **Old seral** | Old seral refers to forests with appropriate old forest characteristics. Ages vary depending on forest type and biogeoclimatic variant. |
| **Operability** | Classification of an area considered available for timber harvesting. Operability is determined based on terrain characteristics and timber quality and quantity in the area. |
| **Partition** | A portion of the AAC that is attributable to certain types of timber and/or terrain. |
| **Person-year(s)** | One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years. |
| **Protected area** | A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations). |
| **Pruning** | The manual removal of the lower branches of crop trees to a predetermined height to produce clear, knot-free wood. |
| **Pulpwood agreements** | An agreement applying to a fixed geographic area that allows harvesting of timber below sawlog standards if mill residues suitable for the facility under the agreement are not available. |
| **Riparian area** | Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes. |

# 9 Glossary

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| **Selection management** | A silvicultural system used to maintain or create an uneven-aged forest by harvesting a limited number of trees of various sizes and ages over time. The time interval between harvests in such areas is fairly short (usually less than 30 years), and during these harvests either single scattered trees or small groups of trees are removed from across the entire area. |
| **Sensitivity analysis** | A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case. |
| **Site index** | A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground). Site index curves have been developed for British Columbia's major commercial tree species. |
| **Stocking** | The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare. |
| **Timber harvesting land base** | Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology. |
| **Timber supply** | The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime. |
| **Timber supply area (TSA)** | An integrated resource management unit established in accordance with *Section 7* of the *Forest Act*. |
| **Unsalvaged losses** | The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested. |
| **Volume estimates (yield projections)** | Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands. |
| **Wildlife tree** | A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife. |
| **Woodlot licence** | An agreement entered into under the *Forest Act*. It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis. |

# Appendix A

## Description of Data Inputs and Assumptions for the Timber Supply Analysis

# Introduction

The following tables and commentary outline the methods and inputs used to derive the timber harvesting land base, and to construct the timber supply model for the Williams Lake TSA Timber Supply analysis. This information represents current forest management in the area.

Current management is defined as the set of land-use decisions and forest and stand management practices currently implemented and enforced. Future forest management objectives that may be intended, but are not currently implemented and enforced, are not included in this appendix.

The purpose of the Timber Supply Review is to provide information on the effects of current management on both short- and long-term timber supply in each timber supply area in the province. Any changes in forest management objectives and practices, and any improvements to the data will be included in subsequent timber supply analyses.

**More detail on the derivation of many of the land base exclusions and modelling approaches is available in the August 1999 *Williams Lake Timber Supply Area Timber Supply Review Data Package.***

## A.1 Inventory Information

In 1998, the chief forester released summary inventory audit results for the Williams Lake TSA forest cover inventory. The preliminary results indicated that mature stand yields in the inventory could be overestimated by 13%. Subsequently, a review of the detailed polygon sample information gathered for the 1998 inventory audit revealed a difference of 12% between the average ground-measured volume of a random sample of all timber types in the Williams Lake TSA and the average inventory volume estimate adjusted by mountain pine beetle disturbance history information. Comparisons cannot be directly made to results of the previous timber supply analysis (1994), as considerations for insect disturbance, stocking class projection and the definition of merchantable forest types has changed significantly and are accounted for in the inventory audit information.

Subsequent to the release of the *Williams Lake Timber Supply Area Timber Supply Review Data Package* in August of 1999, Resources Inventory Branch of the Ministry of Forests received information from ground sampling undertaken as part of the on-going provincial vegetation resources inventory (VRI). The VRI results showed similar trends to the inventory audit but the adjustment ratios were different. The report, *An examination of volume adjustment factors for the Williams Lake TSA*, released in November 2000, completed by Dr. Steve Smith for Resources Inventory Branch, contains volume adjustment factors based on an approach that combined the inventory audit and VRI samples. The volume adjustment factors, listed in Table A-1., were applied to stands sixty years of age and older. A draft version of the volume adjustment factors was used in the base case, and sensitivity analysis was performed when the final numbers were released.

*Table A-1. Volume adjustment factors for stands sixty years of age and older*

| | Stratum | Draft ratio used in the analysis | Final reported ratio |
|---|---|---|---|
| 1 | AC/AT | 0.726 | 0.726 |
| 2 | CH | 0.850 | 0.850 |
| 3 | FD | 1.044 | 1.046 |
| 4 | FD — with logging history | 0.951 | 0.961 |
| 5 | PL — IDF/SBPS | 0.721 | 0.723 |
| 6 | PL — IDF/SBPS – MPB attack | 0.701 | 0.701[a] |
| 7 | PL - | 1.018 | 1.081 |
| 8 | SB | 0.903 | 0.916 |

(a) Correct only when applied to volumes that have previously been adjusted for stand disturbance.

# A.2 Zone and Analysis Unit Definition

## A.2.1 Management zones and tracing multiple objectives (grouping)

Management zones represent areas with distinct management emphasis. For example, a zone may be based on a harvesting system, silviculture system, visual quality objective (VQO) or wildlife consideration. Some areas may contribute to more than one management objective. For simulation modelling, a "group" function makes it possible to associate different stands for reporting, controlling the rate of development or ensuring the maintenance of certain stand characteristics.

Table A-2. provides general descriptions of the management objectives and related information tracked in the analysis. The non-contributing forest (i.e., land considered unavailable for timber harvesting) contribute to forest cover objectives for landscape-level biodiversity and partial retention visual quality.

Further information on the forest cover requirements to be applied to these areas can be found in Section A.4.11, "Forest cover requirements."

*Table A-2. Definition of management objectives*

| Group | Management issue/description |
|---|---|
| 3 western supply blocks | Forecasting of the partitioned harvest in the western supply blocks. |
| Main TSA (all other supply blocks) | Forecasting of the harvest in the main TSA. |
| Forest districts | Reporting of projected harvest by district. |
| Cariboo Chilcotin Land Use Plan resource management zones:<br>• Integrated resource management<br>• Enhanced resource development<br>• Special resource development | For reporting harvest contributions from the CCLUP resource management zones. |
| Eastern and Itcha-Ilgachuz caribou habitat (modified harvest) | Managing the rate of development within the caribou habitat. |
| Innovative Forest Practices Agreement (IFPA) | For reporting on the projected timber supply contribution of the area under the IFPA. |
| Landscape-level biodiversity: mature plus old and old | Maintenance of specified amounts of forest in different age ranges by biogeoclimatic variant for each LU. |
| Mountain pine beetle attacked stands | Reporting harvest levels and silviculture regimes for MPB-attacked stands. |
| Mule deer winter ranges | Risk ratings for mule deer winter ranges are guiding harvesting operations and harvest deferrals are being used to allow recovery of crown closure in high snow pack areas. |
| Multiple use zone | Areas outside of visual resources or partial harvest areas. Includes modification visual areas. |
| Pulpwood agreement #16 | Timber contribution from specified forest types in the PA 16 area. |
| Selection harvesting | For reporting the projected contribution of selection harvesting to TSA timber supply. |
| Visual resource management areas | Partial retention visual areas represent the main category of visual resource management, although lake shore management areas have been included for modelling purposes. |

# A.2 Zone and Analysis Unit Definition

## A.2.2 Analysis units

An analysis unit represents a combination of stands dominated by specific tree species or silvicultural regime with a set range of timber growing capability as indicated by the inventory type group (ITG) and site index in the forest inventory file. Each analysis unit is assigned timber volume projections for both existing and future stands.

For ease of modelling the complex range of silviculture regimes, minimum harvest criteria and wildlife tree requirements, district-level analysis units were used. Forty-seven analysis unit types with up to four age ranges (i.e., stands over 140 years with questionable site index assignments, thrifty stands, existing managed plantations and future managed plantations on sites currently occupied by stands over 140 years of age) within each analysis unit were created. Table A-3. shows generalized analysis unit types without the district component.

## A.2 Zone and Analysis Unit Definition

*Table A-3. Definition of analysis units*

| Analysis unit title | Timber harvesting land base (hectares)[1] |
|---|---|
| Cedar/hemlock | 40 931 |
| Douglas-fir (ICH) | 4 929 |
| Douglas-fir (SBS) | 58 476 |
| Deciduous stands within the PA 16 area | 16 774 |
| Lodgepole pine (ESSF/MS) | 363 748 |
| Lodgepole pine (ICH) | 23 210 |
| Lodgepole pine (IDF) | 182 010 |
| MPB attacked lodgepole pine (IDF) (includes future natural regeneration of unsalvageable MPB attacked stands) | 59 134<br>(16 928) |
| MPB attacked lodgepole pine (SBPS) (includes future natural regeneration of unsalvageable MPB attacked stands) | 153 779<br>(68 743) |
| Lodgepole pine (SBPS) | 538 660 |
| Lodgepole pine (SBS) | 66 546 |
| Lodgepole pine salvage (IDF) | 19 935 |
| Lodgepole pine salvage (SBPS) | 50 695 |
| Spruce/balsam | 188 633 |
| Stands in the eastern caribou arboreal modified harvest area | 9 406 |
| Stands in the Itcha-Ilgachuz arboreal caribou modified harvest area | 18 668 |
| Stands in the Itcha-Ilgachuz terrestrial caribou modified harvest area | 73 362 |
| Douglas-fir (IDF/SBPS) selection | 65 163 |
| Douglas-fir (IDF/SBPS) selection with logging history | 60 703 |
| Mule deer winter range (> = 40% Douglas-fir) with a high or moderate crown closure objective | 90 214 |
| Mule deer winter range (> = 40% Douglas-fir) with a high or moderate crown closure objective and logging history | 31 752 |
| Mule deer winter range (> = 40% Douglas-fir) with a low crown closure objective | 36 785 |
| Mule deer winter range (> = 40% Douglas-fir) with a low crown closure objective and logging history | 25 940 |
| Total timber harvesting land base | 2 179 454 |

Note (1): The area includes beetle-attacked stands expected to regenerate naturally and areas that were deducted after projected harvest to account for future roads.

# A.2 Zone and Analysis Unit Definition

Data source and comments:

The *CCLUP Regional Mule Deer Winter Range Strategy* modified by the *CCLUPIR* identifies the selection harvest methods to be applied to stands with more than 40% fir to achieve crown closure (CC) objectives. The long-range objective in the MDWRs is to create three different crown closure levels with no stands in an early seral condition. Crown closure class targets for each MDWR are identified in the *CCLUP Regional Mule Deer Winter Range Strategy.* To achieve the CC class distribution by MDWR, an assumption was made that the low CC target would likely be met by stands with lower site productivity. A site index cutoff was developed to achieve the CC class distribution. Stands below this productivity were assumed to be managed under a low CC regime while stands above the cutoff were assumed to be managed under a moderate or high CC regime. Stands in MDWRs with less than 40% fir content are assumed to be managed under the appropriate even-aged silvicultural system by leading species.

A complete description of assumptions regarding MPB attacked stands can be found in Section A.4.6.

A category for marginal forest types has not been defined for this analysis.

Given the level of complexity presented in Table A-3., specific PA 16 analysis units were not developed, with the exception of deciduous stands, which did not exist in any other category. Table A-4.lists the timber harvesting land base areas by PA 16 problem forest type.

*Table A-4. Pulpwood agreement 16 analysis unit definition*

| Old PA PFT analysis unit | Inventory type group | Site index (height at 50 years) | Old-site class | Age (years) | Stocking class | Projected height | Supply block | Timber harvesting land base[a] available (hectares) |
|---|---|---|---|---|---|---|---|---|
| 1 | All | | L | | | | H, G, K, M | 9 871 |
| 2 | 35-42 (deciduous) | > = 7 metres | | | | | H, G, K, M | 16 653 |
| 6 | All | | | 140+ | | < 19.5 m | K, M in Horsefly | 603 |
| 7 | 28-31 (pine) | | | | 4 | | H, G | 839 |
| 10 | All | | | 140+ | | | M in Williams Lake | 3 545 |

(a) The timber harvesting land base shown reflects a reduction for wildlife tree patch retention. Areas of site class L with logging disturbance are not included in the area figure.

# A.3 Definition of the Timber Harvesting Land Base

## A.3.1 Land not owned and administered by the province of British Columbia; private forest lands; tree farm licences; leases

The total land base is stratified into various ownership codes. Land must be British Columbia Crown land under provincial administration for it to contribute to the land base used to determine timber supply. Some areas under provincial administration, such as woodlot licences and Tree Farm Licences, do not contribute to timber supply attributable to the TSA.

Woodlot licences are managed for timber production, however, they are administered separately from the TSA. While the Minister of Forests initially apportions a part of the TSA AAC to woodlots, once an AAC is allocated to a specific woodlot licence, the area and the associated AAC are no longer administered as part of the TSA. Consequently, allocated woodlots do not contribute to the TSA timber harvesting land base. Cariboo Forest Region staff indicate that the AAC attributable to woodlots issued since the last AAC determination is about 23 600 cubic metres per year. The woodlots associated with this volume that have not the appropriate ownership code change (i.e., 62-C to 77-N) have been removed.

The following ownership types within the district did not contribute to the timber harvesting land base or other forest management objectives in the TSA, and were excluded from the land base modelled in the analysis:

*Table A-5. Ownership categories that do not contribute to the timber harvesting land base or other forest management objectives in the Williams Lake TSA*

| Ownership code | Definition |
|---|---|
| 40N | Private Crown grant |
| 50N | Federal reserve |
| 52N | Indian reserve |
| 53N | Military reserve |
| 75N | Christmas tree permit |
| 77N | Woodlot licences |
| 99N | Small leases |

## A.3.2 Land classified as non-forest or non-productive forest

Alpine, lakes, rock, etc., represented by inventory type identities 6 and 8, were excluded from being eligible for the timber harvesting land base. These types account for 1 026 803 hectares of the area considered unsuitable for timber harvesting.

## A.3.3 Non-commercial cover

Inventory type identity 5 represents areas currently occupied by non-commercial brush species. These areas are considered unlikely sites for timber production and were considered unavailable for timber harvesting.

# A.3 Definition of the Timber Harvesting Land Base

## A.3.4 Land not administered by the British Columbia Forest Service for timber supply

Land under provincial Crown administration may contribute to forest management objectives even if it is not available for timber harvesting. For example, provincial park land provides old-growth to help achieve biodiversity objectives. Areas with the following ownership codes do not contribute to timber supply in the analysis, but are considered in the assessment of forest cover requirements.

*Table A-6. Ownership categories that are excluded from the timber harvesting land base but contribute to some forest management objectives*

| Ownership code | Definition | Productive forest area (hectares) |
|---|---|---|
| 60N | Crown / ecological reserves | 118 |
| 61C or 61N | Areas assigned for the use, recreation and enjoyment of the public (UREP) | 8 060 |
| 62N | Timber agreement lands | 44 |
| 63N | Class A parks | 169 448 |
| 67N | Provincial parks, park equivalents, or reserves | 2567 |
| 69N | Miscellaneous reserves | 9 982 |

Of the provincial Crown ownership codes occurring within the Williams Lake TSA, only the following are considered to contribute to timber supply for harvest forecast and AAC determination purposes:

*Table A-7. Ownership categories that are included in the timber harvesting land base*

| Ownership code | Definition |
|---|---|
| 62C | Crown forest management unit |
| 69C | Large Crown reserves |

## A.3.5 Environmentally sensitive areas

Some lands are environmentally sensitive and/or significantly valuable for other resources. These areas are identified during a forest inventory as environmentally sensitive areas (ESAs). Table A-8. lists the types of ESAs where no harvesting is expected to take place, and which have been excluded from the timber harvesting land base.

*Table A-8. Description of environmentally sensitive areas*

| ESA category | ESA description | Per cent (%) reduced | Reduced area (hectares)[b] |
|---|---|---|---|
| Es1 | Highly sensitive soils | 100[a] | 92 803 |
| Ep1 | High concern for regeneration problem | 100[a] | 21 857 |
| Ea1 | High avalanche hazard | 100 | 1 061 |
| Eh | Hydrology | 100 | 21 |

(a) This reduction was not applied to areas with logging history. It is recognized that over time, operations will lead to clarification of the areas that can be harvested.

(b) The reduced area is based on the ESA category in the first position. There are many cases where multiple ESA categories apply to a given forest cover polygon.

## A.3.6 Inoperable areas

Operability codes in British Columbia are generally used to describe the presence or absence of physical barriers or limitations to harvesting, appropriate logging methods (e.g., cable) and the merchantability of stands.

Since physical conditions vary across the Williams Lake TSA, two methods have been used to identify inoperable areas. Areas with a logging history on the inventory file were not subjected to the area reduction shown in Table A-9.

*Table A-9. Steep/unstable slopes*

| Slope class | Reduction per cent (%) | Reduced area (hectares) |
|---|---|---|
| Williams Lake Forest District > 40% | 100 | 12 754 |
| Chilcotin Forest District > 40% | 100 | 32 720 |
| Horsefly Forest District — identified areas | 100 | 25 692 |

## A.3.7 Roads, trails and landings reductions

Separate estimates have been made to reflect the loss in productive forest land due to existing and future roads, trails and landings (RTLs). These estimates account for the area on which timber production will not occur in the future, and include reductions to account for reduced productivity.

*Table A-10. Estimates for existing and future roads, trails, and landings*

| Location | Age class | Productive forest area (hectares or per cent) |
|---|---|---|
| Existing unclassified main roads and trails | < 60 years<br>> = 60 years | 14 801<br>15 788 |
| Future main and secondary roads, trails and landings | > = 60 years and not currently roaded | 4.1% — west[a] — 35 349<br>6.2% — east[b] — 11 352 |

(a) 'West' includes all of the Chilcotin Forest District plus the Williams Lake Forest District ESSF, MS, SBPS and IDF.

(b) 'East' includes all of the Horsefly Forest District plus the SBS in the Williams Lake Forest District.

Data source and comments:

Existing unclassified roads and trails are removed from the productive forest land base using a method that identifies the polygon-specific area to be removed in stands under 60 years of age. While the area of unclassified roads and trails in stands over 60 years of age is available (Table A-10.), the volume adjustment factors discussed in Section A-1. included the impact of unclassified roads. This means that some consideration for existing unclassified roads which comprise 15 788 hectares is inherent in the volume adjustment factors. Future RTL reductions were applied to the productive forest land base after stands were harvested for the first time in the simulation model. Future RTL reductions of 4.6% in the East and 3.2% in the West are applied in the model. This reflects both the area currently in existing unclassified roads and trails in stands 60 years of age and older (15 788 hectares) and the future roads, trails and landings required to complete roading activities in the Williams Lake TSA (35 349 hectares in the West and 11 352 hectares in the East). Actual road removal in the model was reduced proportionally to the amount of timber harvesting land base above 60 years of age left unharvested to achieve certain forest cover requirements. Therefore, in the base case harvest forecast, 59 289 hectares were removed for all unclassified roads, trails and landings in stands 60 years of age and older rather than the sum of roads for stands above 60 years of age (62 489 hectares) found in Table A-10.

## A.3.8 Sites with low growth potential and currently unharvested stands

The problem forest type definitions used in the previous analysis were reviewed by regional, district and branch staff. Only the problem forest types listed below in Table A-11. have been retained. The previously used site class 'L' problem forest type has been replaced with the last row of Table A-11., stands with site index below 7 metres. Merchantability has now been captured by three additional categories of stand conditions: stands that are not generally part of the harvest profile; stands that are unlikely to achieve a merchantable height at 160 years of age; and stands that are unlikely to achieve a merchantable volume by some reference age. Table A-11. shows the areas found in the first categories (low site quality and not harvested) while Tables A-12. and A-13. show the latter two categories of merchantability. Merchantable height and volume information can be found in Section A.4.3, "Minimum harvestable criteria and ages."

## A.3 Definition of the Timber Harvesting Land Base

*Table A-11. Areas with low growth potential and stand types that are not being harvested*

| TSR 1 PFT label | Supply block | Species | Inventory type group | Year of logging or age | Height class | Stocking class | Site index | Reduced area (hectares) |
|---|---|---|---|---|---|---|---|---|
| A | A-N[a] | Decid | | < 1988 | | | | 75 780 |
| F2-F4 | N, M, L | Ba | 18-20 | | 2[b] | 1, 2 | < = 12.5 m | 12 071 |
| G2 | B, E-N | S | 21-26 | >140 yrs | 2 | 1, 2 | > = 7 m | 1 614 |
| 3W4 | D | F | 2, 3, 6, 7 | | | | | 2 493 |
| Part of 3W5 | A,C,D | Cw, Hw, Ba | 13-20 | | | | | 6 663 |
| B | All | All | | | | | < 7 m | 207 762 |

(a) Deciduous type does not contain deciduous assigned to PA 16.

(b) Height class has been reduced to 2 as there has been adequate performance in height class 3 within this type.

### A.3.9 Stands not achieving merchantable height or volume

While the broad PFT classifications used in the last TSR analysis were not used in this analysis, new merchantability criteria based on minimum height and volume have been developed after review of cutting permit information. Merchantable height and volume information can be found in Section A.4.3 "Minimum harvestable criteria and ages." The reference age for these assessments was 160 years of age to determine stands that would likely provide adequate harvest attributes in a reasonable time.

*Table A-12. Stands not expected to reach merchantable height or volume*

| Category | Reduced area |
|---|---|
| Stands unlikely to reach merchantable height[a] by 160 years of age | 9 996 |
| Stands unlikely to reach merchantable volume[a] by 160 years of age | 77 118[b] |

(a) See Section A.4.3 "Minimum harvestable criteria and ages".

(b) Excluding insect attacked pine stands which were evaluated separately (see Table A-13., below).

Pine stands in the IDF and SBPS BEC zones were evaluated separately if they had been attacked by mountain pine beetle. First stands were evaluated for their potential to produce adequate sawlog volume of 65 cubic metres per hectare before volume loss as a result of the mountain pine beetle attack. Of stands that could achieve this volume threshold, those with attack class 3 or greater and that met a minimum of 40 cubic metres per hectare of current volume for salvage opportunity were included in the timber harvesting land base. If not, the stand was removed from the current timber harvesting land base and assumed to regenerate back to a harvestable state in the future. For stands with attack class less than 3, post-attack volume below 65 cubic metres per hectare made the stand ineligible for harvest at any time.

*Table A-13. Insect attacked pine stand merchantability criteria.*

| Category | Reduced area (hectares) |
|---|---|
| Stands which were unlikely to reach merchantable sawlog volume by 160 years of age before being attacked by the mountain pine beetle. | 38 193 |
| Stands with attack class 3 or greater which did possess merchantable sawlog volume by 160 years of age and currently have < 40 m³/hectare (below salvage merchantability).[a] | 90 424 |
| Stands with attack class 2 or less that are not eligible for salvage and possess too light a disturbance to assume any natural regeneration. | 19 588 |

(a) These stands are assumed to regenerate naturally. See Section A.4.6, "Mountain pine beetle (MPB) attacked stands."

### A.3.10 Caribou habitat reductions

The *CCLUP* provided direction for management of mountain caribou habitat for two distinct herds known as the Eastern and Itcha-Ilgachuz herds. This direction established a broad deferral on harvesting to the year 2000. Within the deferral area, targets of 65% no-harvest and 35% modified harvest access were established. Table A-14. provides a breakdown of the no-harvest and modified harvest area. About 75 218 hectares were made unavailable for harvest as a result of caribou habitat considerations during the land classification process. Detail is provided under option A of the *CCLUP Caribou Management Strategy Report* and in the *CCLUP Integration Report.*

The *1998 Caribou Strategy Update* revised the modified harvest and no harvest areas specifically managed for Eastern and Itcha-Ilgachuz caribou. The linework of the *1998 Caribou Strategy Update* is considered during operational planning decisions and was modelled as current management.

*Table A-14. Considerations for caribou habitat*

| Location | Type of harvest | Area by harvest category (hectares) | Total productive forest (hectares) |
|---|---|---|---|
| Eastern caribou | Modified harvest | 9 522[a] | 15 613 |
| | No harvest | 39 653[b] | 64 746 |
| Itcha-Ilgachuz caribou | Modified harvest | 92 512[a] | 110 821 |
| | No harvest | 35 565[b] | 39 341 |
| | Existing park | 45 504 | 45 504 |

(a) Area contributing to the timber harvesting land base.

(b) Productive forest area removed through land classification.

### A.3.11 Class A lakes reserve zones

Class A lakes have been identified through a lakes classification process. A no-harvest zone of 200 metres was created around these lakes. This information is available on a non-standard geographic information system (GIS) layer. No special consideration was given to unclassified lakes at this time. A total of 2150 hectares of productive forest area exists within the lake reserves, however, due to overlaps, only 1726 hectares were considered unavailable for harvest specifically due to lakes reserve zone considerations during the land base definition

All lakes in the Horsefly Forest District were classified by the district manager under the *FPC*, or received a draft classification from the Lakes Classification Interagency Planning Team.

In the Williams Lake Forest District, the lake classification team classified approximately 50% of the lakes larger than five hectares. There are 6 class A lakes and 37 class B lakes. Two class A lakes (Natsy, Owen) are identified in the *CCLUP* as important pelican feeding lakes. In addition a 200-metre reserve was be applied to Rosita and Tautri Lakes, important pelican feeding lakes, which have not yet been classified.

There were no classified lakes in the Chilcotin forest district at the time of data collection.

### A.3.12 Riparian management areas

A reduction for the riparian management area (RMA) (riparian reserve zones (RRZ) and riparian management zones(RMZ)) was derived from a district-specific review of silviculture prescriptions approved between 1996 to 1998. The derived RMA factor which includes 100% of the RRZ and a portion of the RMZ was applied to the productive forest after all other land base deductions discussed in previous sections.

*Table A-15. Reductions to reflect riparian management areas*

| Forest district | Area estimate on the timber harvesting land base (%) |
|---|---|
| Chilcotin | 2.3 |
| Williams Lake | 1.4 |
| Horsefly | 2.1 |

### A.3.13 Wildlife tree retention

Each forest district has supplied licensees with landscape unit objectives for wildlife tree retention. A random sample of silviculture prescriptions approved between 1996 and 1998 provided an estimate by forest district of the contribution from stands outside the timber harvesting land base such as riparian, ESAs and deciduous stands (i.e., listed as "N" in the formula below). The study results were generalized for application in the timber supply analysis.

## A.3 Definition of the Timber Harvesting Land Base

*Table A-16. Forest district wildlife tree patch (WTP) statistics based on a random sample of cutting permits*

| Forest district | Per cent (%) contribution from stands outside the timber harvesting land base (N) | Percentage of WTs or WTPs less than two hectares | Percentage of WTPs greater than two hectares (A) |
|---|---|---|---|
| Williams Lake | 21 | $0^{a}$ | 100 |
| Horsefly | 11 | 60 | 40 |
| Chilcotin | 25 | $0^{a}$ | 100 |

**Note:** (a) Study found that less than 10% of WTPs are smaller than two hectares or are single WTs. This was assumed to be insignificant for this analysis.

To determine the area found in WTP > two hectares, the following formula was used:

$W=[(T-3) \times (1-N/100)] \times A/100$

Where:

W= percentage of WTPs larger than two hectares that will be managed on longer rotations and be replaced by adjacent forest at the next harvest

T= District Manager LU WTP target. The 3% deduction accounts for the expected contribution of landscape-level old-seral retention to WTP objectives

N= contribution from stands outside the timber harvesting land base such as riparian, ESAs and deciduous stands

A= percentage of WTPs greater than two hectares in size

A total of 93 663 hectares of WTPs was reserved from harvest in clearcut stands, including a consideration for mountain pine beetle attacked stands that are assumed to regenerate naturally. WTP targets were not applied in selection management areas such as the dry-belt fir-leading stands, MDWR selection and caribou modified-harvest analysis units as the silvicultural systems used in these areas are assumed to maintain the desired structural diversity within stands. While this WTP area may be harvested at some time in the future, for the analysis the area was assumed to be permanently unavailable for harvest.

*Table A-17. Reductions to reflect wildlife tree patch areas*

| Forest district | Area required for wildlife tree patch retention > 2 hectares in size (hectares) | Area-weighted average impact on the timber harvesting land base (%) |
|---|---|---|
| Chilcotin | 58 405 | 4.7 |
| Williams Lake | 27 861 | 4.3 |
| Horsefly | 7 397 | 1.9 |

An additional 3% of wildlife tree and small (< 2 hectares) wildlife tree patch retention is employed in the Horsefly Forest District. This amount is removed from the yield tables for the corresponding analysis units at the time of harvest.

*Table A-18. Current district wildlife tree patch targets (%) and biodiversity emphasis by landscape unit*

| Landscape unit | Biodiversity emphasis | Chilcotin district | Williams Lake district | Horsefly district |
|---|---|---|---|---|
| Alexis | I | 12 | . | . |
| Alkali | I | . | 12 | . |
| Alplands | I | 10 | . | . |
| Anaham | I | 12 | 12 | . |
| Atnarko | I | 10 | . | . |
| Bambrick | L | 11 | 10 | . |
| Beaver_Valley | L | . | 12 | 9 |
| Beece_Creek | L | 10 | 12 | . |
| Beeftrail | H | 10 | . | . |
| Bidwell_Lava | I | 10 | . | . |
| Big_Creek | L | 14 | 10 | . |
| Big_Lake | L | . | 10 | 9 |
| Big_Stick | L | 10 | . | . |
| Black_Creek | I | . | . | 9 |
| Brittany | L | 10 | . | . |
| Cariboo_Lake | L | . | . | 9 |
| Cheshi_Stikelan | L | 11 | . | . |
| Chilanko | L | 10 | . | . |
| Chilko | L | 3 | . | . |
| Chimney | H | . | 14 | . |
| Christensen_Creek | I | 9 | . | . |
| Churn | I | . | 8 | . |
| Clearwater | L | 10 | . | . |
| Clisbako | I | 10 | . | . |
| Clusko | I | 10 | . | . |
| Colwell | L | 10 | . | . |
| Corkscrew | H | 9 | . | . |
| Crazy_Creek | L | 8 | . | . |
| Dash | L | . | 10 | . |
| Dog_Creek | I | . | 12 | . |
| Doran_Creek | L | 8 | . | . |
| Downton | I | 6 | . | . |
| East_Arm | I | . | . | 9 |
| Eastside | I | . | . | 9 |
| Farwell | I | . | 12 | . |
| Gaspard | I | . | 12 | . |
| Gunn_Valley | L | 7 | . | . |
| Haines | L | 11 | 11 | . |
| Hawks_Creek | I | . | 14 | 9 |
| Hickson | L | 3 | . | . |
| Holtry | I | 10 | . | . |
| Horsefly | I | . | . | 9 |
| Hotnarko | I | 10 | . | . |
| Klinaklini | I | 11 | . | . |
| Koster-Lone_Cabin | H | . | 6 | . |
| Likely | L | . | . | 9 |

*(continued)*

*Table A-18. Current district wildlife tree patch targets (%) and biodiversity emphasis by landscape unit (concluded)*

| Landscape unit | Biodiversity emphasis | Chilcotin district | Williams Lake district | Horsefly district |
|---|---|---|---|---|
| Little_River | I | . | . | 9 |
| Lord_River | L | 7 | . | . |
| Lower_Cariboo | L | . | . | 9 |
| Mackin | L | 11 | 12 | . |
| McKay | L | . | . | 9 |
| McKinley | H | . | . | 9 |
| McKusky | L | . | . | 9 |
| McLinchy | I | 10 | . | . |
| Meldrum | I | . | 14 | . |
| Middle_Lake | L | 10 | . | . |
| Minton | H | 13 | 13 | . |
| Mitchell_Lake | I | . | . | 9 |
| Moffat | L | . | 9 | 9 |
| Nadila | L | 10 | 3 | . |
| Nazko | L | 10 | 10 | . |
| Nemiah | H | 9 | . | . |
| Niagara | I | . | . | 9 |
| Nimpo | L | 10 | . | . |
| Nostetuko | L | 9 | . | . |
| Nude_Creek | L | 5 | . | . |
| Nuntzi_Elkin | L | 7 | . | . |
| Ottorasko | L | 5 | . | . |
| Palmer_Jorgenson | I | 10 | . | . |
| Penfold | I | . | . | 9 |
| Polley | H | . | . | 9 |
| Punky_Moore | I | 10 | . | . |
| Puntzi | L | 10 | . | . |
| Pyper | L | 10 | . | . |
| Riske | I | 10 | 12 | . |
| Sisters | I | 11 | . | . |
| Siwash | I | 13 | . | . |
| Taseko | L | 10 | 10 | . |
| Tatla_Little_Eagle | L | 10 | . | . |
| Tautri | L | 11 | 10 | . |
| Tchaikazan | L | 8 | . | . |
| Telegraph | H | 10 | . | . |
| Tete_Angela | L | 10 | 10 | . |
| Tiedemann | L | 4 | . | . |
| Tusulko | I | 10 | . | . |
| Twan | H | 12 | 12 | . |
| Upper_Big_Creek | L | 4 | 4 | . |
| Upper_Churn | L | . | 10 | . |
| Upper_Dean | I | 10 | . | . |
| Upper_Tatlayoko | I | 10 | . | . |
| Wasko_Lynx | L | . | . | 9 |
| Westbranch | H | 10 | . | . |
| Westside | I | . | . | 9 |
| Williams_Lake | I | . | 14 | 9 |

# A.4 Forest Management Assumptions

## A.4.1 Utilization levels

The utilization levels define the maximum stump height, minimum top diameter inside bark (dib) and minimum diameter at breast height (dbh) by species and were used in the analysis to calculate merchantable volume.

*Table A-19. Utilization levels*

| | Utilization | | |
|---|---|---|---|
| **Analysis unit** | **Minimum dbh (cm)** | **Maximum stump height (cm)** | **Minimum top dib (cm)** |
| Pine leading | 12.5 | 30 | 10 |
| All other species | 17.5 | 30 | 10 |
| Pulpwood agreement 16 types | 12.5 | 30 | 10 |

## A.4.2 Harvesting priorities and targets

Individual harvest targets were applied for the main TSA, western supply blocks, total TSA, PA 16 areas and salvage harvest of eligible mountain pine beetle attacked stands.

Harvest priority for the timber harvesting land base was relative-oldest first (i.e., relative age as the difference between current age and the minimum harvestable age assigned to the stand type).

There was no explicit priority placed on harvesting selection stands at their respective return intervals with the exception of caribou modified harvest stands. Given the use of the forest cover requirement limiting the rate of development in caribou habitat areas, maintaining prompt re-entry intervals was assumed to be necessary to ensure an adequate reflection of harvest potential in these areas. Generally, partial harvest stands outside of caribou habitat were harvested beyond the minimum return interval.

Mountain pine beetle (MPB) attacked stands with salvage potential were given high priority for harvest to evaluate the maximum harvest in the first five years of the analysis. Stands left unharvested after the first five years were transferred to a younger age based on the description found in Section A.4.6, "Mountain pine beetle (MPB) attacked stands."

Stands were given priority if they were identified in harvest depletion information supplied by the Chilcotin Forest District to reflect the planned harvest pattern in 1998 (areas not updated for harvest depletion after the creation of the inventory file).

Pulpwood Agreement 16 harvest types were identified in order to track harvest contribution. To ensure that these stands contributed to the short-term harvest, they were given a high priority. A harvest request of 107 000 cubic metres per year (the level of the existing partition to these types) from these stand types was modelled.

# A.4 Forest Management Assumptions

## A.4.3 Minimum harvestable criteria and ages

The data package outlined general minimum harvest criteria (Table A-20.) to be used in determining both whether the stands are merchantable and should be in the timber harvesting land base, and the earliest these stands are expected to be available for harvest. These minimum criteria are a significant departure from TSR 1 and provide significant flexibility in the timber supply analysis.

*Table A-20. Minimum harvest criteria*

| Analysis unit | Minimum criteria: Diameter @ breast height (cm) | Minimum criteria: Volume ($m^3$/hectare) | Minimum criteria: Inventory height (metres) |
|---|---|---|---|
| Pine stands | 12.5 | 65 | Williams Lake and Horsefly — 15<br>Chilcotin — 13 |
| Mountain pine beetle attacked pine with < 65 $m^3$/hectare | 12.5 | 40[a] | Chilcotin — 13 |
| All other conifers | 17.5 | 65 | 17 |
| Deciduous (PA 16) | 12.5 | 65 | 17 |

(a) An additional minimum of 25 cubic metres per hectare is assumed to exist as dead potential volume for salvage operations.

Minimum harvestable ages for all clearcut analysis units are shown in Table A-22. Those for partially harvested stands can be found in Table A-28. The minimum harvestable age for clearcut stands is generally determined by the minimum volume. If stands are harvested at the minimum volume, the final column in Table A-22. shows the actual growth captured as a percentage of the maximum growth rate. It is important to remember that sensitivity analysis (Section 5.3.2) showed that minimum harvestable age can be increased significantly before implications to timber supply occur. Table A-21. provides a key to the analysis unit labels (second columns in Tables A-22. and A-28.).

*Table A-21. Regeneration key for analysis units*

| Analysis unit information | Description |
|---|---|
| 1000 series | Stands currently older than 140 years of age |
| 2000 series | Stands between the age of management[a] and 140 years of age |
| 3000 series | Future plantations after harvest of stands currently above 140 years of age |
| 4000 series | Existing managed plantations and the post-harvest analysis unit for 2000 series stands |
| N descriptor | Natural regeneration |
| P descriptor | Planted |
| G descriptor | Genetic stock |
| T descriptor | Thinned |

(a) 34 years and less in the main TSA and 20 years in the western supply blocks.

# A.4 Forest Management Assumptions

*Table A-22. Minimum harvestable age*

| Label (district/species/BEC zone)[a] | Analysis unit | Age for required height (years) | Age to reach minimum volume (years) | Maximum average growth rate | Age to reach the maximum average growth rate (years) | Minimum harvest age (years) | % of the maximum growth rate captured at minimum harvest age |
|---|---|---|---|---|---|---|---|
| APL_ESSF/MS | 1151 | 90 | 90 | 1.08 | 140 | 90 | 74% |
| APL_ESSF/MS | 3151n_ | 90 | 100 | 1.09 | 170 | 100 | 65% |
| APL_ESSF/MS | 3151p_ | 90 | 90 | 1.21 | 160 | 90 | 64% |
| APL_ESSF/MS | 2151 | 80 | 80 | 1.21 | 130 | 80 | 70% |
| APL_ESSF/MS | 4151n_ | 80 | 90 | 1.29 | 150 | 90 | 65% |
| APL_ESSF/MS | 4151p_ | 80 | 80 | 1.44 | 140 | 80 | 64% |
| APL_IDF | 1121 | 80 | 100 | 0.83 | 140 | 100 | 84% |
| APL_IDF | 3121n_ | 90 | 100 | 1.09 | 160 | 100 | 76% |
| APL_IDF | 3121nt | 90 | 90 | 1.12 | 150 | 90 | 71% |
| APL_IDF | 2121 | 70 | 90 | 1 | 130 | 90 | 83% |
| APL_IDF | 4121n_ | 70 | 80 | 1.34 | 140 | 80 | 65% |
| APL_IDF | 4121nt | 70 | 80 | 1.39 | 140 | 80 | 71% |
| APL_MPBeetleIDF | 1129 | 90 | 130 | 0.56 | 140 | 130 | 99% |
| APL_MPBeetleIDF | 3129n_ | 90 | 100 | 1.01 | 170 | 100 | 73% |
| APL_MPBeetleIDF | 3129nt | 90 | 100 | 1.05 | 170 | 100 | 79% |
| APL_MPBeetleIDF | 2129 | 80 | 120 | 0.62 | 130 | 120 | 97% |
| APL_MPBeetleIDF | 4129n_ | 80 | 90 | 1.22 | 150 | 90 | 72% |
| APL_MPBeetleIDF | 4129nt | 80 | 80 | 1.26 | 150 | 80 | 65% |
| APL_MPBeetleSBPS | 1139 | 90 | 130 | 0.53 | 140 | 130 | 99% |
| APL_MPBeetleSBPS | 3139n_ | 90 | 100 | 0.98 | 160 | 100 | 71% |
| APL_MPBeetleSBPS | 3139p_ | 90 | 100 | 1.17 | 150 | 100 | 74% |
| APL_MPBeetleSBPS | 2139 | 80 | 120 | 0.63 | 130 | 120 | 97% |
| APL_MPBeetleSBPS | 4139n_ | 80 | 90 | 1.25 | 150 | 90 | 75% |
| APL_MPBeetleSBPS | 4139p_ | 80 | 80 | 1.47 | 140 | 80 | 65% |
| APL_Salvage3+IDF | 1429 | 90 | 120 | 0.37 | 150 | 120 | 93% |
| APL_Salvage3+IDF | 3429n_ | 100 | 100 | 0.89 | 180 | 100 | 65% |
| APL_Salvage3+IDF | 3429nt | 100 | 90 | 0.93 | 170 | 100 | 71% |
| APL_Salvage3+IDF | 2429 | 70 | 100 | 0.49 | 130 | 100 | 87% |
| APL_Salvage3+IDF | 4429n_ | 80 | 70 | 1.29 | 150 | 80 | 63% |
| APL_Salvage3+IDF | 4429nt | 80 | 70 | 1.33 | 130 | 80 | 69% |
| APL_Salvage3+SBPS | 1439 | 90 | 130 | 0.33 | 150 | 130 | 98% |
| APL_Salvage3+SBPS | 3439n_ | 100 | 90 | 0.91 | 160 | 100 | 67% |
| APL_Salvage3+SBPS | 3439p_ | 100 | 90 | 1.09 | 170 | 100 | 69% |
| APL_Salvage3+SBPS | 2439 | 70 | 100 | 0.52 | 130 | 100 | 89% |
| APL_Salvage3+SBPS | 4439n_ | 70 | 70 | 1.44 | 140 | 70 | 53% |
| APL_Salvage3+SBPS | 4439p_ | 70 | 70 | 1.66 | 130 | 70 | 59% |
| APL_SBPS | 1131 | 90 | 100 | 0.8 | 140 | 100 | 83% |
| APL_SBPS | 3131n_ | 90 | 100 | 1.05 | 170 | 100 | 74% |
| APL_SBPS | 3131p_ | 90 | 90 | 1.24 | 150 | 90 | 65% |
| APL_SBPS | 2131 | 70 | 90 | 0.94 | 130 | 90 | 81% |
| APL_SBPS | 4131n_ | 80 | 90 | 1.29 | 150 | 90 | 75% |
| APL_SBPS | 4131p_ | 80 | 80 | 1.49 | 150 | 80 | 67% |

Notes:

(a) First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

# A.4 Forest Management Assumptions

*Table A-22. Minimum harvestable age*

| Label (district/species/BEC zone)[a] | Analysis unit | Age for required height (years) | Age to reach minimum volume (years) | Maximum average growth rate | Age to reach the maximum average growth rate (years) | Minimum harvest age (years) | % of the maximum growth rate captured at minimum harvest age |
|---|---|---|---|---|---|---|---|
| AS/B | 1102 | 120 | 110 | 1.11 | 200 | 120 | 73% |
| AS/B | 3102pg | 110 | 100 | 1.71 | 180 | 110 | 60% |
| AS/B | 2102 | 100 | 90 | 1.35 | 160 | 100 | 72% |
| AS/B | 4102p_[b] | 90 | 80 | 2.16 | 160 | 90 | 58% |
| AS/B | 4102pg | 90 | 80 | 2.2 | 160 | 90 | 61% |
| BFD_SBS | 1243 | 60 | 70 | 1.75 | 130 | 70 | 74% |
| BFD_SBS | 3243n_ | 60 | 50 | 2.93 | 100 | 60 | 72% |
| BFD_SBS | 3243nt | 60 | 50 | 3 | 100 | 60 | 74% |
| BFD_SBS | 3243p_ | 60 | 50 | 3.11 | 100 | 60 | 85% |
| BFD_SBS | 3243pt | 60 | 50 | 3.2 | 90 | 60 | 85% |
| BFD_SBS | 2243 | 50 | 50 | 2.43 | 110 | 50 | 58% |
| BFD_SBS | 4243n_ | 50 | 50 | 3.79 | 90 | 50 | 68% |
| BFD_SBS | 4243nt | 50 | 40 | 3.88 | 90 | 50 | 70% |
| BFD_SBS | 4243p_ | 40 | 40 | 4.01 | 70 | 40 | 60% |
| BFD_SBS | 4243pt | 40 | 40 | 4.14 | 80 | 40 | 63% |
| BPA16deciduous | 8208 | 70 | 80 | 0.94 | 100 | 80 | 94% |
| BPL_ESSF/MS | 1251 | 120 | 90 | 1.09 | 140 | 120 | 95% |
| BPL_ESSF/MS | 3251n_ | 120 | 110 | 1.02 | 170 | 120 | 82% |
| BPL_ESSF/MS | 3251p_ | 120 | 100 | 1.14 | 150 | 120 | 89% |
| BPL_ESSF/MS | 2251 | 100 | 90 | 1.17 | 140 | 100 | 86% |
| BPL_ESSF/MS | 4251n_ | 110 | 90 | 1.22 | 150 | 110 | 84% |
| BPL_ESSF/MS | 4251p_ | 100 | 90 | 1.36 | 140 | 100 | 85% |
| BPL_IDF | 1221 | 90 | 90 | 0.94 | 130 | 90 | 83% |
| BPL_IDF | 3221n_ | 90 | 80 | 1.39 | 140 | 90 | 81% |
| BPL_IDF | 3221nt | 90 | 80 | 1.43 | 140 | 90 | 85% |
| BPL_IDF | 2221 | 70 | 70 | 1.24 | 130 | 70 | 77% |
| BPL_IDF | 4221n_ | 70 | 70 | 1.93 | 110 | 70 | 73% |
| BPL_IDF | 4221nt | 70 | 60 | 1.98 | 120 | 70 | 78% |
| BPL_MPBeetleIDF | 1229 | 100 | 120 | 0.59 | 140 | 120 | 96% |
| BPL_MPBeetleIDF | 3229n_ | 110 | 100 | 1.1 | 150 | 110 | 88% |
| BPL_MPBeetleIDF | 3229nt | 110 | 90 | 1.14 | 160 | 110 | 90% |
| BPL_MPBeetleIDF | 2229 | 90 | 110 | 0.7 | 130 | 110 | 94% |
| BPL_MPBeetleIDF | 4229n_ | 90 | 80 | 1.34 | 140 | 90 | 79% |
| BPL_MPBeetleIDF | 4229nt | 90 | 80 | 1.39 | 140 | 90 | 83% |
| BPL_MPBeetleSBPS | 1239 | 100 | 120 | 0.61 | 140 | 120 | 96% |
| BPL_MPBeetleSBPS | 3239n_ | 110 | 90 | 1.16 | 160 | 110 | 90% |
| BPL_MPBeetleSBPS | 3239p_ | 100 | 80 | 1.36 | 150 | 100 | 85% |
| BPL_MPBeetleSBPS | 2239 | 90 | 100 | 0.76 | 130 | 100 | 90% |
| BPL_MPBeetleSBPS | 4239n_ | 90 | 80 | 1.44 | 140 | 90 | 82% |
| BPL_MPBeetleSBPS | 4239p_ | 90 | 70 | 1.66 | 130 | 90 | 87% |

Notes:

(a) First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

(b) Existing spruce plantations above the age of 8 that were planted with stock of unknown genetic value.

*(continued)*

# A.4 Forest Management Assumptions

*Table A-22. Minimum harvestable age*

| Label (district/species/BEC zone)[a] | Analysis unit | Age for required height (years) | Age to reach minimum volume (years) | Maximum average growth rate | Age to reach the maximum average growth rate (years) | Minimum harvest age (years) | % of the maximum growth rate captured at minimum harvest age |
|---|---|---|---|---|---|---|---|
| BPL_Salvage3+IDF | 1529 | 100 | 120 | 0.36 | 140 | 120 | 95% |
| BPL_Salvage3+IDF | 3529n_ | 110 | 80 | 1.09 | 160 | 110 | 85% |
| BPL_Salvage3+IDF | 3529nt | 110 | 80 | 1.12 | 150 | 110 | 90% |
| BPL_Salvage3+IDF | 2529 | 100 | 100 | 0.47 | 140 | 100 | 85% |
| BPL_Salvage3+IDF | 4529n_ | 100 | 80 | 1.17 | 160 | 100 | 82% |
| BPL_Salvage3+IDF | 4529nt | 100 | 70 | 1.21 | 140 | 100 | 86% |
| BPL_Salvage3+SBPS | 1539 | 130 | 130 | 0.34 | 150 | 130 | 98% |
| BPL_Salvage3+SBPS | 3539n_ | 130 | 100 | 0.87 | 190 | 130 | 89% |
| BPL_Salvage3+SBPS | 3539p_ | 130 | 90 | 1.05 | 170 | 130 | 90% |
| BPL_Salvage3+SBPS | 2539 | 100 | 110 | 0.48 | 140 | 110 | 91% |
| BPL_Salvage3+SBPS | 4539n_ | 110 | 80 | 1.16 | 160 | 110 | 90% |
| BPL_Salvage3+SBPS | 4539p_ | 100 | 80 | 1.36 | 150 | 100 | 85% |
| BPL_SBPS | 1231 | 100 | 100 | 0.89 | 140 | 100 | 87% |
| BPL_SBPS | 3231n_ | 100 | 90 | 1.21 | 150 | 100 | 84% |
| BPL_SBPS | 3231p_ | 100 | 80 | 1.42 | 140 | 100 | 87% |
| BPL_SBPS | 2231 | 70 | 80 | 1.23 | 130 | 80 | 83% |
| BPL_SBPS | 4231n_ | 70 | 70 | 1.78 | 120 | 70 | 69% |
| BPL_SBPS | 4231p_ | 70 | 60 | 2.05 | 110 | 70 | 75% |
| BPL_SBS | 1241 | 50 | 50 | 2.35 | 100 | 50 | 70% |
| BPL_SBS | 3241n_ | 50 | 50 | 2.83 | 90 | 50 | 59% |
| BPL_SBS | 3241nt | 50 | 50 | 2.92 | 100 | 50 | 63% |
| BPL_SBS | 3241p_ | 50 | 50 | 3.22 | 90 | 50 | 68% |
| BPL_SBS | 3241pt | 50 | 50 | 3.32 | 90 | 50 | 71% |
| BPL_SBS | 2241 | 40 | 50 | 2.57 | 100 | 50 | 76% |
| BPL_SBS | 4241n_ | 50 | 50 | 3.36 | 90 | 50 | 69% |
| BPL_SBS | 4241nt | 50 | 50 | 3.44 | 90 | 50 | 72% |
| BPL_SBS | 4241p_ | 40 | 40 | 3.75 | 80 | 40 | 51% |
| BPL_SBS | 4241pt | 40 | 40 | 3.89 | 80 | 40 | 55% |
| BS/B | 1202 | 110 | 100 | 1.25 | 180 | 110 | 70% |
| BS/B | 3202pg | 100 | 90 | 1.98 | 170 | 100 | 64% |
| BS/B | 2202 | 60 | 70 | 2.13 | 130 | 70 | 70% |
| BS/B | 4202p_[b] | 60 | 60 | 3.7 | 100 | 60 | 60% |
| BS/B | 4202pg | 50 | 50 | 4.04 | 90 | 50 | 44% |
| DC/H | 1307 | 70 | 80 | 0.85 | 90 | 80 | 99% |
| DC/H | 3307p_ | 70 | 60 | 2.58 | 120 | 70 | 81% |
| DC/H | 3307pt | 70 | 60 | 2.64 | 110 | 70 | 81% |
| DC/H | 2307 | 60 | 60 | 2.05 | 90 | 60 | 73% |
| DC/H | 4307p_ | 60 | 50 | 2.9 | 100 | 60 | 72% |
| DC/H | 4307pt | 60 | 50 | 2.93 | 110 | 60 | 73% |

Notes:

(a) First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

(b) Existing spruce plantations above the age of 8 that were planted with stock of unknown genetic value.

*(continued)*

## A.4 Forest Management Assumptions

*Table A-22. Minimum harvestable age*

| Label (district/species/BEC zone)[a] | Analysis unit | Age for required height (years) | Age to reach minimum volume (years) | Maximum average growth rate | Age to reach the maximum average growth rate (years) | Minimum harvest age (years) | % of the maximum growth rate captured at minimum harvest age |
|---|---|---|---|---|---|---|---|
| DFD_ICH | 1363 | 70 | 60 | 1.9 | 130 | 70 | 76% |
| DFD_ICH | 3363p_ | 70 | 50 | 2.59 | 100 | 70 | 88% |
| DFD_ICH | 3363pt | 70 | 50 | 2.65 | 110 | 70 | 89% |
| DFD_ICH | 2363 | 60 | 60 | 2.17 | 130 | 60 | 65% |
| DFD_ICH | 4363p_ | 60 | 50 | 2.94 | 100 | 60 | 82% |
| DFD_ICH | 4363pt | 60 | 50 | 3.03 | 100 | 60 | 84% |
| DFD_SBS | 1343 | 60 | 60 | 2.15 | 130 | 60 | 66% |
| DFD_SBS | 3343n_ | 60 | 50 | 3.15 | 100 | 60 | 76% |
| DFD_SBS | 3343nt | 60 | 50 | 3.21 | 90 | 60 | 78% |
| DFD_SBS | 3343p_ | 50 | 50 | 3.36 | 90 | 50 | 72% |
| DFD_SBS | 3343pt | 50 | 40 | 3.47 | 90 | 50 | 74% |
| DFD_SBS | 2343 | 50 | 50 | 2.49 | 110 | 50 | 56% |
| DFD_SBS | 4343n_ | 50 | 50 | 3.67 | 90 | 50 | 65% |
| DFD_SBS | 4343nt | 50 | 50 | 3.72 | 90 | 50 | 68% |
| DFD_SBS | 4343p_ | 50 | 40 | 3.88 | 80 | 50 | 82% |
| DFD_SBS | 4343pt | 50 | 40 | 4.01 | 80 | 50 | 82% |
| DPA16deciduous | 8308 | 40 | 60 | 1.57 | 90 | 60 | 87% |
| DPL_ESSF | 1351 | 50 | 50 | 2.35 | 100 | 50 | 74% |
| DPL_ESSF | 3351n_ | 50 | 50 | 2.98 | 100 | 50 | 56% |
| DPL_ESSF | 3351p_ | 50 | 50 | 3.3 | 90 | 50 | 73% |
| DPL_ESSF | 2351 | 50 | 50 | 2.62 | 100 | 50 | 76% |
| DPL_ESSF | 4351n_ | 50 | 50 | 3.17 | 90 | 50 | 61% |
| DPL_ESSF | 4351p_ | 50 | 40 | 3.5 | 80 | 50 | 77% |
| DPL_ICH | 1361 | 40 | 50 | 2.75 | 90 | 50 | 80% |
| DPL_ICH | 3361p_ | 40 | 40 | 3.64 | 90 | 40 | 46% |
| DPL_ICH | 3361pt | 40 | 40 | 3.74 | 90 | 40 | 50% |
| DPL_ICH | 2361 | 40 | 50 | 2.64 | 90 | 50 | 79% |
| DPL_ICH | 4361p_ | 40 | 40 | 3.7 | 80 | 40 | 48% |
| DPL_ICH | 4361pt | 40 | 40 | 3.83 | 80 | 40 | 52% |
| DPL_SBPS | 1331 | 40 | 50 | 2.01 | 90 | 50 | 82% |
| DPL_SBPS | 3331n_ | 40 | 40 | 3.91 | 80 | 40 | 54% |
| DPL_SBPS | 3331p_ | 40 | 40 | 4.36 | 70 | 40 | 65% |
| DPL_SBPS | 2331 | 40 | 50 | 2.07 | 90 | 50 | 82% |
| DPL_SBPS | 4331n_ | 40 | 40 | 3.89 | 80 | 40 | 53% |
| DPL_SBPS | 4331p_ | 40 | 40 | 4.29 | 70 | 40 | 65% |
| DPL_SBS | 1341 | 40 | 40 | 2.7 | 90 | 40 | 63% |
| DPL_SBS | 3341n_ | 40 | 40 | 3.7 | 80 | 40 | 48% |
| DPL_SBS | 3341nt | 40 | 40 | 3.79 | 80 | 40 | 52% |
| DPL_SBS | 3341p_ | 40 | 40 | 4.13 | 70 | 40 | 59% |

Notes:

(a) First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

*Table A-22. Minimum harvestable age (concluded)*

| Label (district/species/BEC zone)[a] | Analysis unit | Age for required height (years) | Age to reach minimum volume (years) | Maximum average growth rate | Age to reach the maximum average growth rate (years) | Minimum harvest age (years) | % of the maximum growth rate captured at minimum harvest age |
|---|---|---|---|---|---|---|---|
| DPL_SBS | 3341pt | 40 | 40 | 4.26 | 80 | 40 | 63% |
| DPL_SBS | 2341 | 30 | 40 | 3.15 | 80 | 40 | 69% |
| DPL_SBS | 4341n_ | 40 | 40 | 4.31 | 70 | 40 | 60% |
| DPL_SBS | 4341nt | 40 | 40 | 4.39 | 70 | 40 | 64% |
| DPL_SBS | 4341p_ | 30 | 40 | 4.77 | 70 | 40 | 73% |
| DPL_SBS | 4341pt | 30 | 40 | 4.94 | 70 | 40 | 75% |
| DS/B | 1302 | 80 | 70 | 1.64 | 140 | 80 | 75% |
| DS/B | 3302pg | 70 | 70 | 2.89 | 130 | 70 | 56% |
| DS/B | 2302 | 60 | 60 | 2.12 | 120 | 60 | 60% |
| DS/B | 4302p_[b] | 50 | 50 | 3.84 | 100 | 50 | 38% |
| DS/B | 4302pg | 50 | 50 | 4.11 | 90 | 50 | 46% |

Notes:
(a) First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.
(b) Existing spruce plantations above the age of 8 that were planted with stock of unknown genetic value.

### A.4.4 Volume exclusions for mixed species stands

The deciduous species in predominantly coniferous stands are generally not harvested. These portions were therefore excluded from the estimates of stand volumes. These exclusions do not apply operationally to Pulpwood Agreement 16 analysis units as deciduous trees make up a component of eligible harvest.

*Table A-23. Volume exclusions for mixed species types*

| Analysis units | Species | Volume exclusion (%) |
|---|---|---|
| All | All deciduous | 100 |

Data source and comments:

The exclusion pertains only to the deciduous portions of these analysis units. The deciduous portion does contribute to biodiversity and coarse woody debris objectives at the stand level and was considered in the cutting permit review of WTs and WTPs, Section A.3.13, "Wildlife tree and tree patch retention."

### A.4.5 Forest inventory operational discrepancy types (Cw, Hw)

The western redcedar (Cw) and western hemlock (Hw) forest inventory operational discrepancy types found in the Horsefly Forest District are those stands where the recovered volumes at harvest are significantly overestimated by variable density yield prediction (VDYP) model due to higher decay, waste and breakage (DWB) than the DWB factors assigned to these stands. Forest District staff indicate that generally recovered volume on these areas is 50 to 60% below the volume predicted by VDYP. The per cent volume reductions shown in Table A-24. were applied to 36 142 hectares.

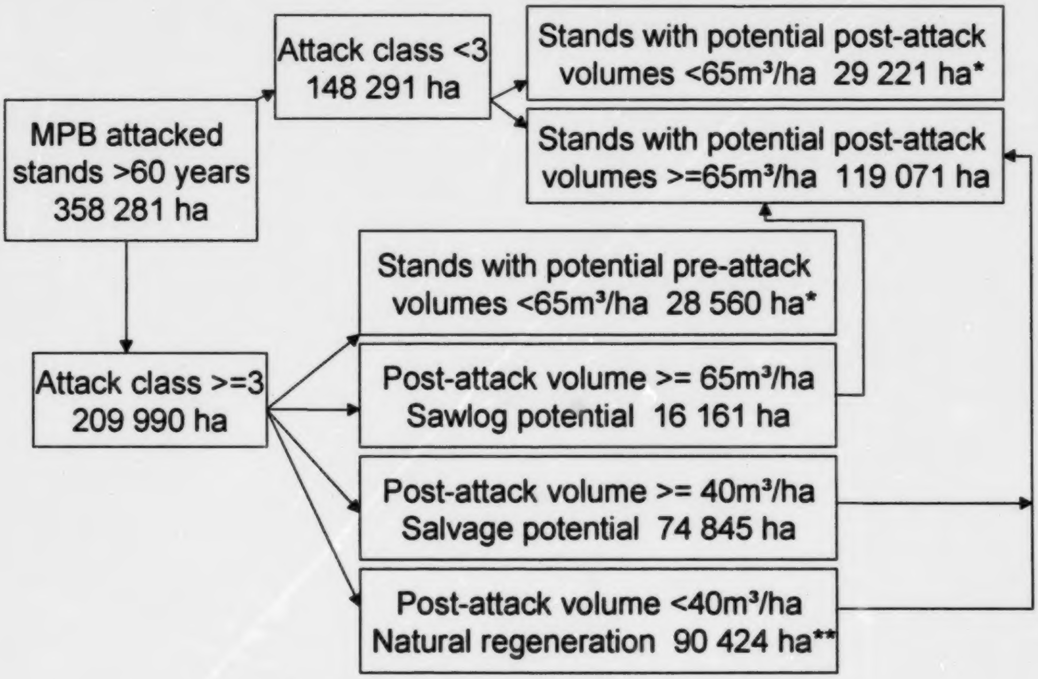
*Table A-24. Volume exclusions for forest inventory operational discrepancy types*

| TSR 1 PFT type | Supply block | Species | Type group | Age class | Stocking class | Site index | Old-site class | Per cent (%) volume excluded |
|---|---|---|---|---|---|---|---|---|
| D2 | J-N | Cw | 9-11 | 8-9 | 1, 2 | > = 7.0 | G, M, P | 50 |
| E2-E3 | J-N | Hw | 12-17 | 8-9 | 1, 2 | > = 7.0 | G, M, P | 60 |

### A.4.6 Mountain pine beetle (MPB) attacked stands

In the previous analysis, the estimated unsalvaged loss of merchantable wood within pine stands attacked by mountain pine beetle (MPB) was depicted by labelling 123 000 hectares of timber harvesting land base as NSR (complete loss of standing volume) and applying a 20-year regeneration delay.

A reclassification of most of the MPB-attacked portions of the Chilko and Stum PSYUs was done in the early 1990s using photos taken between 1985 and 1993. This allowed modelling of the salvage of MPB attacked stands and its implications to biodiversity. The classification provided an estimate of the per cent of the polygon area which was attacked. The peak of the beetle attack was in 1986. For this analysis, the epidemic levels of MPB attack are assumed to have been over by 1990; therefore this is the date used as the 'last year of attack' and the date for the beginning of stand recovery.


MPB attacked stands >60 years 358 281 ha
Attack class <3 148 291 ha
Stands with potential post-attack volumes <65m³/ha 29 221 ha*
Stands with potential post-attack volumes >=65m³/ha 119 071 ha
Attack class >=3 209 990 ha
Stands with potential pre-attack volumes <65m³/ha 28 560 ha*
Post-attack volume >= 65m³/ha Sawlog potential 16 161 ha
Post-attack volume >= 40m³/ha Salvage potential 74 845 ha
Post-attack volume <40m³/ha Natural regeneration 90 424 ha**

Notes: Areas shown are prior to reductions for WTPs
*—These areas are reflected in the first and third rows of Table A-13.
**— This area is reflected in the second row of Table A-13.

*Figure A-1. Evaluation criteria for mountain pine beetle attacked stands in the crown productive — Williams Lake TSA, 2001.*

## A.4 Forest Management Assumptions

Figure A-1. shows the areas found in different categories of mountain pine beetle(MPB) attacked stands at least sixty years of age without consideration for wildlife tree patches. Areas in wildlife tree patches were deducted for the analysis, as discussed in the main report, Section 5.6 "Uncertainty in salvage operations and natural regeneration of low volume mountain pine beetle (MPB) attacked stands."

About one-third of the stands have light disturbance and are not eligible for salvage under the current licence requirements. These stands are evaluated for their ability to provide adequate sawlog volume. The other two-thirds of the MPB-attacked stands fall into one of four categories:

1. Stands unable to produce adequate sawlog volume before the MPB attack were excluded in the timber harvesting land base for the entire analysis horizon.
2. Stands that still retain sawlog potential, that is, possess volume above 65 cubic metres per hectare, were placed in an analysis unit with less disturbed stands and considered part of the timber harvesting land base.
3. Stands that have between 40 and 65 cubic metres per hectare were assumed to have salvage potential
4. Stands with less than 40 cubic metres per hectare were assumed to be currently unmerchantable but were regenerated to a lightly disturbed analysis unit (e.g., mountain pine beetle attacked pine in the timber harvesting land base) using the age conversions listed in Table A-25., "Harvesting and silvicultural assumptions for mountain pine beetle attacked stands." The assignment to this analysis unit assumes that regenerating post-attack pine stands are expected to have less volume that naturally regenerated undisturbed pine stands.

Stands that have not been salvage harvested in the first five years of the analysis will also be transferred to a younger age on the same yield table as the lightly disturbed analysis units in the timber harvesting land base. The timing of age conversion reflects the existence of residual trees in the lower attack classes providing some stand attributes for an extended period of time.

*Table A-25. Harvesting and silvicultural assumptions for mountain pine beetle (MPB) attacked stands*

| Attack class (range of mountain pine beetle attack %) | Yield reduction if harvested (%) for stands > = 60 years of age | Time (years) until stand converts to young forest from 1990 | Age of young forest after conversion (years) |
|---|---|---|---|
| < 3 (6-25%) | Area-weighted average | N/A | N/A |
| 3 (26-35%) | 40 | 39 | 40 |
| 4 (36-45%) | 50 | 29 | 30 |
| 5 (46-55%) | 60 | 24 | 20 |
| 6 (56-65%) | 70 | 19 | 10 |
| 7+ (66-100%) | 100 | 14 | 0 |

In the Tatla Lake area, substantial mountain pine beetle attacked areas were not assigned an attack level. Stands with no attack percentage indicated are believed to have the same distribution as the classified areas based on an approximate relationship with crown closure class for stands above seven metres in site index and forty years of age. Table A-26. shows the attack classes assigned by crown closure class. It is interesting to note the trend in reduced attack level with reduced average age. The table also shows that most of the classified and unclassified areas are in crown closure classes from 1 to 5 after MPB attack.

# A.4 Forest Management Assumptions

*Table A-26. Assigning insect attack levels to unclassified mountain pine beetle attacked stands*

| Crown closure class | Classified productive forest area (hectares) | Area-weighted MPB attack class | Area-weighted average age | Unclassified productive forest area |
|---|---|---|---|---|
| 0 | 2 178 | 4.7 | 128 | 200 |
| 1 | 20 924 | 6.2 | 154 | 3 184 |
| 2 | 75 206 | 5.0 | 134 | 10 401 |
| 3 | 91 475 | 3.4 | 128 | 23 780 |
| 4 | 58 696 | 2.1 | 122 | 16 325 |
| 5 | 37 336 | 1.6 | 110 | 12 652 |
| 6 | 12 855 | 1.5 | 93 | 8 915 |
| 7 | 1 980 | 1.6 | 88 | 4 218 |
| 8 | 232 | 1.6 | 96 | 663 |
| 9 | 31 | 1.0 | 97 | 115 |
|  | 300 912 |  |  | 80 451 |

### A.4.7 Silvicultural systems

Even-aged silviculture systems with varying levels of retention are used for approximately 80% of the volume harvested from the Williams Lake TSA. The other 20% is harvested using selection management or some form of partial harvesting. Guidance from the data package provided the four partial harvest regimes shown in Table A-27.

## A.4 Forest Management Assumptions

*Table A-27. Partial harvest silvicultural system management guidelines*

| Silvicultural emphasis | Description | Per cent (%) removal on first entry | Percentage of maximum average growth rate | Time between entries (years) |
|---|---|---|---|---|
| Normal selection harvest | IDF/SBPS fir-leading outside MDWRs and MDWR low CC areas with fir > = 40% | 50 | 100% of existing natural stand | 30 |
| MDWR selection and VQO R | MDWRs — all stands with fir > = 40%, in moderate and high crown closure classes and stands in the visual retention class | 20 | 66% of the existing natural stand | 50 |
| Terrestrial lichen sites | All stands outside of those listed for arboreal lichen sites within the modified harvest for Western caribou. | 50 | 100% of the existing natural stand | 70 |
| Arboreal lichen sites | 20% of the western caribou (specifically includes all spruce leading stands, stands in the ESSF and stands in the MS above 175 years of age) and all of the eastern caribou modified harvest | 33 | 66% of the existing natural stand | 80 |

The reference to the maximum average growth rate for the existing natural stands in Table A-28. (below, 3rd column) signifies that while certain yield tables have been developed for stands that have already been partially harvested based on the forest cover attributes found in the inventory file, these yields do not necessarily reflect the true site productivity. For instance in Fir in the IDF/SBPS (AFD_dry) listed in Table A-28., the existing natural stand has a maximum average growth rate of 0.79 cubic metres per hectare per year while the maximum for stands with a logging history is 0.67 cubic metres per hectare per year. The yield tables used in modelling were modified slightly to ensure that the volume harvested in subsequent harvest entries represents the desired percentage of the maximum average growth rate in the existing natural stand (i.e., 0.79 cubic metres per hectare per year). After initial harvest, stands were regenerated to an advanced age on the logging history analysis unit with the exception of stands in caribou habitat, which do not have any logging history. In this case, stands remain on the same yield table as before harvest. By retaining the yield table for stands with logging history the current total growing stock is more reflective of the current inventory file.

# A.4 Forest Management Assumptions

*Table A-28. Silviculture and harvesting regimes for partial harvest systems*

| Label (district/species)[a] | Analysis unit | Maximum average growth rate ($m^3$/ha/yr) | Minimum harvest age | Age after initial entry | %volume removal | Minimum time between harvests | Growth captured at minimum harvest age | % of natural productivity |
|---|---|---|---|---|---|---|---|---|
| AFD_dry | 9113 | 0.79 | 170 | 110 | 51 | 30 | | |
| AFD_dryLog | 9114 | 0.67 | 110 | 80 | 36 | 30 | 0.8 | 100 |
| AMDWR-FirHi | 9175 | 0.91 | 170 | 120 | 17 | 50 | | |
| AMDWR-FirHiLog | 9176 | 0.96 | 170 | 120 | 19 | 50 | 0.61 | 66 |
| AMDWR-FirLo | 9185 | 0.63 | 120 | 120 | 46 | 30 | | |
| AMDWR-FirLoLog | 9186 | 0.35 | 120 | 90 | 53 | 30 | 0.63 | 100 |
| BFD_dry | 9213 | 1.2 | 170 | 110 | 54 | 30 | | |
| BFD_dryLog | 9214 | 0.9 | 110 | 80 | 39 | 30 | 1.2 | 100 |
| BMDWR-FirHi | 9275 | 1.47 | 170 | 120 | 28 | 50 | | |
| BMDWR-FirHiLog | 9276 | 1.47 | 170 | 120 | 21 | 50 | 0.99 | 67 |
| BMDWR-FirLo | 9285 | 0.88 | 120 | 100 | 55 | 30 | | |
| BMDWR-FirLoLog | 9286 | 0.58 | 100 | 70 | 60 | 30 | 0.88 | 100 |
| DMDWR-FirHi | 9375 | 2.33 | 170 | 140 | 22 | 50 | | |
| DMDWR-FirHiLog | 9376 | 2.02 | 140 | 90 | 28 | 50 | 1.53 | 66 |
| DMDWR-FirLo | 9385 | 2.01 | 120 | 90 | 67 | 30 | | |
| DMDWR-FirLoLog | 9386 | 1.17 | 120 | 90 | 43 | 30 | 2.01 | 100 |
| Dcaribou_East | 9700 | 1.34 | 160 | 80 | 33 | 80 | 0.89 | 66 |
| Acaribou_West Arboreal | 9800 | 1.04 | 160 | 80 | 33 | 80 | 0.69 | 66 |
| Acaribou_West Terrestrial | 9900 | 1.01 | 140 | 70 | 50 | 70 | 1.01 | 100 |

(a) First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

Data source and comments:

To ensure that stands in mule deer winter range (MDWR) attained the required crown closure (CC) prior to initial harvest in this analysis, the risk assessment contained in the *CCLUP Regional Mule Deer Winter Range Strategy, Appendix A* (which identifies winter ranges at greatest risk of not meeting CC requirements) was used to determine the harvest deferral (years) before harvesting can take place in any mule deer winter range. Mule deer winter range stands with less than 40% fir were assumed to be harvested using even-aged silvicultural systems.

# A.4 Forest Management Assumptions

*Table A-29. Harvest deferrals by risk category for mule deer winter range*

| Risk that harvesting will impact crown closure targets | Harvest deferral in years |
|---|---|
| Low | 0 |
| Moderate | 20 |
| High | 40 |
| Very high | 50 |

### A.4.8 Regeneration activities in managed stands

Recently regenerated and future stands were grown on managed stand yield tables (MSYTs) produced using the British Columbia Forest Service's table interpolation program for stand yields (TIPSY) growth and yield model. Table A-30. contains the inputs required to produce managed stand yield tables for this analysis. Deciduous stands in PA 16 are assumed to regenerate back to the existing natural yield table and are not included. While the data package listed several other silviculture activities, any that applied to less than 15% of an analysis unit were removed in order to simplify the data structure for modelling. In addition, some species and BEC zone combinations had current densities below the original post-thinning density shown in the data package. These were replaced with higher initial densities, shown in bold, to capture the ingress in these types. In addition, for modelling purposes, analysis units which are managed through some form of partial cutting regime have been removed from the managed stand tables.

# A.4 Forest Management Assumptions

*Table A-30. Regeneration assumptions by analysis unit*

| Species | BEC zone | Time to reach adequate stocking after harvest (years) | Regen type | Per cent (%) | Species | Per cent (%) | Density initial (stems/ha) | Density thinned (stems/ha) (% of AU thinned) |
|---|---|---|---|---|---|---|---|---|
| Fdi | ICH | 2 | Plant | 100 | Pli, | 50 | 1525 | 1900 (15) |
| | | | | | Fdi, | 30 | **3400** | |
| | | | | | Sx | 20 | | |
| Fdi | SBS | 4 | Natural | 60 | Pli | 50 | 6150 | 1800 (35) |
| | | | | | Fdi | 30 | | |
| | | | | | Sx | 20 | | |
| | SBS | 2 | Plant | 40 | Pli | 50 | 3415 | 1800 (35) |
| | | | | | Fdi | 30 | | |
| | | | | | Sx | 20 | | |
| Pli | SBS | 4 | Natural | 60 | Pli | 80 | 6150 | 1800 (35) |
| | | | | | Sx | 10 | | |
| | | | | | Fdi | 10 | | |
| | SBS | 2 | Plant | 40 | Pli | 75 | 3415 | 1800 (35) |
| | | | | | Sx | 25 | | |
| Pli | SBPS | 4 | Natural | 80 | Pli | 90 | 6145 | 1800 |
| | | | | | Sx | 10 | | |
| | SBPS | 2 | Plant | 20 | Pli | 80 | 2501 | 1800 |
| | | | | | Sx | 20 | | |
| Pli | ESSF, MS | 4 | Natural | 60 | Pli | 80 | 6053 | 1600 |
| | | | | | Sx | 20 | | |
| | ESSF, MS | 2 | Plant | 40 | Pli | 80 | 2409 | 1600 |
| | | | | | Sx | 20 | | |
| Pli | IDF | 4 | Natural | 100 | PLI | 80 | 6061 | 1800 (40) |
| | | | | | Fdi | 10 | | |
| | | | | | Sx | 10 | | |
| Pli | ICH | 2 | Plant | 100 | Pli | 60 | 1525 | 1800 (15) |
| | | | | | Sx | 30 | **3415** | |
| | | | | | Fdi | 10 | | |
| Cw, Hw | ICH | 2 | Plant | 100 | Pli | 40 | 1525 | 1800 (15) |
| | | | | | Sx | 30 | **3000** | |
| | | | | | Fdi | 20 | | |
| | | | | | Cw | 5 | | |
| | | | | | Hw | 5 | | |
| Sx, Ba | All | 2 | Plant | 100 | Sx | 80 | 1746 | |
| | | | | | Pli | 20 | | |

# A.4 Forest Management Assumptions

Data source and comments:

Stock age for planted areas is one year and is generally two years for naturally regenerated areas. The stock age has been accounted for in the third column of Table A-30. to provide the length of time when no trees are present after logging. The time interval listed (2 years for planted stands and 4 years for natural stands) is used explicitly in forest estate modelling rather than being factored into the yield table through an age adjustment.

In constructing MSYTs in TIPSY v3.0a, operational adjustment factors (OAFs) of 12% for OAF1, and 5% for OAF 2 were used. OAF 1 is a constant percentage reduction to account for small stocking gaps in stands. OAF 2 accounts for losses that increase with age, for example, due to disease. The value of OAF 2 increases from zero to a maximum of value (e.g., 5%) when the stand is 100 years old. In the Williams Lake TSA a review of ISIS data indicated that the average well-spaced stocking was over 90% of targets. The Ministry of Forests, Research Branch staff indicated that while stocking has implications for the development of OAF 1, stocking only represents about 3-percentage points of the factor.

## A.4.9 Managed stand history

While the previous section outlines the current silviculture regimes used in the Williams Lake TSA, a number of existing plantations that warrant assignment to managed stand yield tables based on practices used at the time of establishment. The data package indicated that clearcut stands under 34 years of age in the main TSA and under 20 years of age in the 3 western supply blocks were growing as managed stands. Given these criteria, there are currently 291 498 hectares of managed stands within the Williams Lake TSA. Assigning a silviculture regime for this group of stands entailed comparing the inventory file information with the silviculture treatments found in Table A-30. for regeneration method and thinning regime. This provided a match of activities for about 78% of stands in the managed category. The remaining 22% of stands possessed silviculture activities which are generally not anticipated to occur (e.g., thinning spruce-leading stands) or occur infrequently and were not modelled. These stands were assigned to the most representative activity for that species and BEC combination (e.g., naturally regenerated pine in the SBPS with thinning activity was assumed to be planted, naturally regenerated spruce was assumed to be planted, etc). Also, spruce stands 8 years of age and younger are assumed to have genetic benefits due to the use of known genetic material while spruce stands above 8 years of age do not include any genetic gain.

## A.4.10 Not-satisfactorily restocked (NSR) areas

According to inventory file, the timber harvesting land base there is over 140 000 hectares of NSR. District major licensee silviculture information system/integrated silviculture information system (MLSIS/ISIS) records from September of 1998 showed the total to be 86 325 hectares as listed in the data package. Most of the NSR in the file has a projected age of zero. Since it is known that this age often does not reflect actual conditions, a method was required to distribute the NSR into annual ages to reflect activity levels in different landscape units. The following algorithm provided a reasonable method of approximation:

Logging-based age = 1997 - (last year of logging) - 4 years regeneration delay.

Where 1997 represents the year most stands have been updated to.

Table A-31. compares the area-weighted projected inventory age with the logging-based age. The table shows that according to the inventory, there is a significant amount of area with an age of zero and very little area between zero and 5 years old. This is the time required for many stands to be legally classified as SR and is not necessarily an indication of the age of the trees on the site.

The negative ages are a modelling construct to represent the length of time needed for trees to be established naturally or artificially on recently logged areas. Given that a significant area has no associated age, the projected inventory age of 0 could be expected to correspond to areas with logging-based ages ranging from -6 (either very recently logged and not yet re-forested, or backlog NSR) to +4 years old (ready to be surveyed and classified as SR). For areas with logging-based age 6, about half of the stands possess a projected inventory age of six while the other half still retain a projected inventory age of 0 (creating an area-weighted inventory age of 3). By roughly 8 years to 9 years of age, the projected inventory age and the logging-based inventory age are the same.

The logging-based ages provide a more even and realistic distribution of area in annual ages, and reflect NSR of about 88 988 hectares (all stands less than logging-based age of 3 years, the earliest age a stand is likely to be called satisfactorily restocked). Logging-based ages of –5 and –6 are assigned to stands that are assumed to be associated with the backlog NSR listed in the data package. These stands have either a logging-based age above 15 years but a projected inventory age of 0, or no available logging-based age (i.e., no logging year recorded). This area is roughly 10 400 hectares.

# A.4 Forest Management Assumptions

*Table A-31. Comparing logging history age for stands with a projected inventory age less than 21 years*

| Area-weighted projected inventory age (years) | Timber harvesting land base using projected inventory age (hectares) | Logging-based age (years) | Timber harvesting land base using logging-based age (hectares) |
|---|---|---|---|
| 0 | — | − 6 | 4 775 |
| 0 | — | − 5 | 5 698 |
| 0 | — | − 4 | 5 141 |
| 0 | — | − 3 | 9 311 |
| 0 | — | − 2 | 14 429 |
| 0 | — | − 1 | 12 211 |
| 0 | 126 553 | 0 | 12 723 |
| 0 | — | 1 | 12 415 |
| 0 | 158 | 2 | 12 284 |
| 0.3 | 956 | 3 | 10 654 |
| 0.6 | 1 665 | 4 | 11 419 |
| 1.5 | 3 264 | 5 | 10 920 |
| 3.3 | 5 091 | 6 | 9 243 |
| 5.0 | 6 652 | 7 | 9 234 |
| 6.9 | 10 018 | 8 | 11 689 |
| 8.6 | 10 294 | 9 | 10 724 |
| 9.7 | 9 204 | 10 | 9 506 |
| 10.6 | 11 023 | 11 | 11 423 |
| 11.7 | 11 732 | 12 | 12 034 |
| 12.2 | 8 668 | 13 | 9 226 |
| 13.8 | 7 963 | 14 | 8 059 |
| 14.7 | 5 573 | 15 | 5 694 |
| 16 | 5 739 | 16 | 5 739 |
| 17 | 6 484 | 17 | 6 484 |
| 18 | 7 573 | 18 | 7 573 |
| 19 | 7 827 | 19 | 7 827 |
| 20 | 7 345 | 20 | 7 345 |
| Total | | | 253 781 |

# A.4 Forest Management Assumptions

## A.4.11 Forest cover requirements

As noted in Section A.2.1, "Management zones and tracing multiple objectives (grouping)," forest cover requirements were applied to model management for a number of objectives. The role of forest outside the timber harvesting land base was assumed to contribute to achieving forest cover requirements related to visual quality and biodiversity. All other forest management objectives apply only to the timber harvesting land base since the requirements are controls for rates of development on the timber harvesting land base. Where forest cover requirements are expressed using a height criteria, the age at which regenerated stands are expected to achieve this height was estimated using *Batch SiteTools v 3.2j*. for each species. Then the ages were averaged within the management unit. (For example, the area-weighted age at which stands in the integrated resources management area within the Williams Lake landscape unit reach 3 metres was 14 years). A total of 862 forest cover requirements were modelled after removing requirements that applied to very little timber harvesting land base, or where forest outside the timber harvesting land base provided the required amount of mature or old forest).

### A.4.11.1 Forest cover requirements — multiple use areas

Multiple use areas are areas where the primary concern is cutblock adjacency, and that are not subject to either visual resource management requirements or partial harvest systems,. Mountain pine beetle attacked stands play an interesting role in operational planning as the attacked stands themselves are not restricted from harvest due to cutblock adjacency but once harvested can impact adjacent stands that have not been attacked and are subject to adjacency. Landscape units where this is required or the amount of pine salvage harvest is significantly reduced are: Alexis, McLinchy, Pyper, Siwash and Sisters. All other landscape units are able to support the salvage within the green-up requirements listed in Table A-32 After salvage harvest, the harvested stands are incorporated into the disturbed area for the multiple use forest cover requirement listed in Table A-32.

*Table A-32. Forest cover requirements for multiple use areas within each draft landscape unit*

| | Green-up height (metres) | Maximum allowable disturbance (% area) less than green-up height | Area of application |
|---|---|---|---|
| Multiple use areas[a] | 3 | 30 | Timber harvesting land base |
| Chilcotin Forest District[a] | 3 | 30 | Non-mountain pine beetle attacked timber harvesting land base |

(a) Does not include selection harvested areas or visual areas.

### A.4.11.2 Forest cover requirements — visual resource areas

The forest cover requirements for visual resources listed in the data package were modified upon review of the sizes of the different categories. Table A-33. lists the visual resource management categories modelled in the analysis for all clearcut stands. Areas that are subject to partial harvest system were not included in the visual resource management zones since the desired visual characteristics are expected to be maintained after partial harvests. Stands in retention visual quality areas were modelled as partial harvests within the MDWR high crown closure analysis unit. Lakeshore buffers (about 9900 hectares of future timber harvesting land base) were incorporated into the visual categories listed below (Table A-33.). About a third of this area was already within the visual categories listed.

*Table A-33. Forest cover requirements for visual resource management within each draft landscape unit*

| Forest district | VQO or VSA | Green-up height (metres) | Maximum allowable disturbance (% area) less than green-up height | Application |
|---|---|---|---|---|
| Chilcotin | Yes | 3 | 15 | Forested area[a] |
| Williams Lake | PR | 3 | 15 | Forested area[a] |
| Horsefly | PR | 5 | 20 | Forested area[a] |

(a) Does not include selection harvested areas.

### A.4.11.3 Forest cover requirements — caribou habitat areas

For Eastern and Itcha-Ilgachuz caribou modified harvest areas, the goal is to maintain lichen-bearing habitat by employing extended rotations and minimizing fragmentation of the landscape. The latter is controlled by allowing a maximum amount of area to be harvested within a landscape unit every 20 years. With the partial cutting silviculture system described in Section A.4.7, "Silvicultural systems," stands are assumed to regenerate to an advanced age (e.g., 80 years in terrestrial lichen sites). Once the maximum area is harvested in a landscape unit, adjacent stands are not eligible for harvest until 20 years passes, resulting in the terrestrial lichen site green-up age of 100 years. Generally speaking, there are few landscape units where stands below the age of 80 years significantly affect the rate of harvest as result of using this modelling approach.

*Table A-34. Forest cover requirements for caribou habitat within each draft landscape unit*

| Habitat type | Green-up age[a] (years) | Maximum allowable disturbance (% area) | Application |
|---|---|---|---|
| Terrestrial lichen sites | 100 | 33% | Timber harvesting land base |
| Arboreal lichen sites | 90 | 33% | Timber harvesting land base |

(a) Stands harvested in the caribou habitat types are regenerated to an advanced age. The minimum age listed is 20 years higher than the regeneration age so that the maximum harvested area is 33% of the caribou area within a landscape unit. Once the harvested area ages for 20 years, the landscape unit is eligible for additional harvesting.

### A.4.11.4 Forest cover requirements — mule deer winter ranges

Over the long term, certain stand characteristics will be actively managed and maintained in the mule deer winter range habitat types. These were modelled by requiring different amounts of the timber harvesting land base to be above specified ages, depending on the prevailing habitat type in each mule deer winter range. Because most of the mule deer winter range is in the IDF BEC zone, the minimum age listed in Table A-35. is 250 years to assure old forest conditions in moderate and high crown closure areas and 140 years to ensure some contribution to mature forest conditions across all crown closure areas.

*Table A-35. Forest cover requirements within each mule deer winter range*

| Habitat type | Minimum age (years) | Minimum retention (% of area) | Application |
|---|---|---|---|
| Moderate and high crown closure objectives | 250<br>140 | 25%<br>50% | Partial harvest timber harvesting land base |
| Low crown closure objectives | 140 | 25% | Partial harvest timber harvesting land base |

#### A.4.11.5 Forest cover requirements — landscape biodiversity

The *Biodiversity Conservation Strategy* provides guidance for the retention of old and mature plus old forest conditions across the landscape. To ensure that both old and mature-plus-old seral targets are met throughout the Williams Lake TSA, the forest cover requirements listed in Table A-36. were applied to draft landscape units and were modelled using the assigned biodiversity emphasis (BE) found in Table A-18. Values reflect the *Biodiversity Guidebook and the Landscape Unit Planning Guide,* with the exception of the IDF where the *Biodiversity Conservation Strategy* was used.

## A.4 Forest Management Assumptions

*Table A-36. Minimum percentage requirements for mature and old seral forest within each draft landscape unit*

| | | Mature+old seral requirement by biodiversity emphasis | | | Old-seral requirement by biodiversity emphasis | | |
|---|---|---|---|---|---|---|---|
| NDT | BEC zone | L | I | H | L | I | H |
| 1 | CWH | 18 | 36 | 54 | 13 | 13 | 19 |
| 1 | ICH | 17 | 34 | 51 | 13 | 13 | 19 |
| 1 | ESSF | 19 | 36 | 54 | 19 | 19 | 28 |
| 1 | MH | 19 | 36 | 54 | 19 | 19 | 28 |
| 2 | CWH | 17 | 34 | 51 | 9 | 9 | 13 |
| 2 | ICH | 15 | 31 | 46 | 9 | 9 | 13 |
| 2 | SBS | 15 | 31 | 46 | 9 | 9 | 13 |
| 2 | ESSF | 14 | 28 | 42 | 9 | 9 | 13 |
| 3 | SBPS | 8 | 17 | 25 | 7 | 7 | 10 |
| 3 | SBS | 11 | 23 | 34 | 11 | 11 | 16 |
| 3 | MS | 14 | 26 | 39 | 14 | 14 | 21 |
| 3 | ESSF | 14 | 23 | 34 | 14 | 14 | 21 |
| 3 | ICH | 14 | 23 | 34 | 14 | 14 | 21 |
| 4 | ICH | 17 | 34 | 51 | 13 | 13 | 19 |
| 4 | IDF – Fd | 22 | 43 | 65 | 21 | 21 | 32 |
| 4 | IDF – other | 11 | 23 | 34 | 11 | 11 | 16 |

L=low biodiversity emphasis; I=intermediate biodiversity emphasis; H=high biodiversity emphasis.

The data package indicated that a review of small variants (below 5000 hectares) within landscape units could lead to combining some BEC variants to simplify analysis. Valley bottom variants within some landscape units were not combined with other variants even if their area was small. About 144 000 hectares of productive forest was re-assigned through a filtering process that involved considering the prevalent BEC variant relationships within the TSA, the largest three BEC variants within a landscape unit, and the variants with more than 4000 hectares within a landscape unit. The final assignments for modelling were provided by the Williams Lake Forest Region staff (Table A-37.).

# A.4 Forest Management Assumptions

*Table A-37. BEC variant re-assignments by landscape unit — for modelling purposes only*

| Landscape unit name | Inventory BEC variant | BEC variant modelled |
|---|---|---|
| Alkali | BGxh3 | IDFxm |
| Alkali | BGxw2 | IDFxm |
| Anaham | SBPSdc | SBPSxc |
| Atnarko | ESSFxv1 | MSxv |
| Atnarko | IDFdw | SBPSxc |
| Bambrick | IDFdk4 | SBPSxc |
| Bambrick | ESSFxv1 | ESSFxv2 |
| Beaver_Valley | ICHwk2 | ICHmk3 |
| Beaver_Valley | SBPSmk | SBSdw2 |
| Beaver_Valley | SBSmh | SBSdw1 |
| Beece_Creek | MSxv | ESSFxv1 |
| Beece_Creek | SBPSxc | MSdv |
| Beeftrail | ESSFxv1 | MSxv |
| Bidwell_Lava | IDFdw | IDFdk4 |
| Big_Creek | BGxw2 | IDFdk4 |
| Big_Creek | ESSFxv2 | MSxv |
| Big_Creek | IDFxm | IDFdk4 |
| Big_Lake | SBSmc1 | SBSdw1 |
| Big_Lake | IDFdk3 | SBSdw2 |
| Big_Stick | MSdc2 | ESSFxv1 |
| Big_Stick | MSxv | SBPSxc |
| Black_Creek | ESSFwc3 | ESSFwk1 |
| Black_Creek | SBSmc1 | SBSdw1 |
| Brittany | ESSFxv1 | MSxv |
| Brittany | IDFdw | IDFdk4 |
| Cariboo_Lake | SBSwk1 | ESSFwk1 |
| Chilanko | MSxv | SBPSxc |
| Chilko | MSxv | MSdc2 |
| Chimney | BGxw2 | IDFxm |
| Churn | BGxh3 | IDFdk4 |
| Churn | BGxw2 | IDFdk4 |
| Churn | ESSFxv2 | MSxv |
| Churn | IDFxm | IDFdk4 |
| Clearwater | ESSFxv1 | MSxv |
| Clisbako | SBPSmk | SBPSdc |
| Colwell | ESSFxv1 | MSdc2 |
| Colwell | IDFdw | MSdc2 |
| Colwell | MSxv | MSdc2 |
| Crazy_Creek | MSdc2 | ESSFxv1 |
| Dash | SBPSxc | MSxv |
| Dog_Creek | BGxh3 | IDFxm |
| Dog_Creek | BGxw2 | IDFxm |
| Dog_Creek | SBPSmk | IDFdk3 |
| Doran_Creek | ESSFxv1 | CWHds1 |
| Doran_Creek | MHmm2 | CWHds1 |
| East_Arm | ICHwk1 | ICHwk2 |
| Edmond | CWHds1 | ESSFxv1 |

*(continued)*

## A.4 Forest Management Assumptions

*Table A-37. BEC variant re-assignments by landscape unit — for modelling purposes only*

| Landscape unit name | Inventory BEC variant | BEC variant modelled |
|---|---|---|
| Farwell | BGxh3 | IDFxm |
| Farwell | BGxw2 | IDFxm |
| Farwell | SBPSmk | IDFdk4 |
| Franklyn | CWHds1 | ESSFxv1 |
| Franklyn | IDFdw | ESSFxv1 |
| Gaspard | BGxw2 | IDFdk4 |
| Gaspard | IDFxm | IDFdk4 |
| Gunn_Valley | SBPSxc | MSdv |
| Haines | ESSFxv1 | MSxv |
| Haines | ESSFxv2 | MSxv |
| Haines | IDFxm | IDFdk4 |
| Hawks_Creek | IDFxm | IDFdk3 |
| Hawks_Creek | SBSmc1 | SBSdw2 |
| Hickson | ESSFxv1 | CWHds1 |
| Hickson | MHmm2 | CWHds1 |
| Holtry | ESSFxv1 | MSxv |
| Horsefly | ESSFwc3 | ESSFwk1 |
| Horsefly | SBSdw1 | ICHmk3 |
| Hotnarko | ESSFxv1 | MSxv |
| Hotnarko | IDFdw | SBPSxc |
| Klinaklini | IDFdk4 | SBPSxc |
| Koster-Lone_Cabin | BGxh3 | IDFxm |
| Koster-Lone_Cabin | BGxw2 | IDFxm |
| Koster-Lone_Cabin | IDFdk3 | IDFdk4 |
| Koster-Lone_Cabin | SBPSmk | IDFdk4 |
| Likely | ESSFwc3 | ESSFwk1 |
| Likely | ICHmk3 | ICHwk2 |
| Lower_Cariboo | ICHmk3 | ICHwk2 |
| Lower_Cariboo | ICHwk4 | ICHwk2 |
| Mackin | IDFdk4 | IDFdk3 |
| Mackin | IDFxm | IDFdk3 |
| Mackin | SBPSdc | SBPSxc |
| McKinley | ESSFwc3 | ESSFwk1 |
| McKinley | SBSdw1 | ICHmk3 |
| McLinchy | ESSFxv1 | MSxv |
| Minton | BGxw2 | IDFxm |
| Mitchell_Lake | ICHwk4 | ICHwk2 |
| Moffat | ESSFwc3 | ESSFwk1 |
| Moffat | SBSdw1 | SBPSmk |
| Moffat | SBSdw2 | SBPSmk |
| Nazko | IDFdk4 | SBPSxc |
| Nazko | SBPSmk | SBPSdc |
| Nemiah | ESSFxv1 | MSxv |
| Nude_Creek | CWHds1 | IDFdw |
| Nude_Creek | MHmm2 | ESSFxv1 |
| Nuntzi_Elkin | ESSFxv1 | MSxv |

*(continued)*

# A.4 Forest Management Assumptions

*Table A-37. BEC variant re-assignments by landscape unit — for modelling purposes only (concluded)*

| Landscape unit name | Inventory BEC variant | BEC variant modelled |
|---|---|---|
| Palmer_Jorgenson | ESSFxv1 | MSxv |
| Palmer_Jorgenson | IDFdk4 | SBPSxc |
| Polley | ICHwk2 | ICHmk3 |
| Polley | SBSmw | ICHmk3 |
| Polley | SBSwk1 | SBSmh |
| Pyper | MSxv | SBPSxc |
| Rainbow | CWHds1 | IDFdw |
| Rainbow | MSdv | MSdc2 |
| Riske | BGxh3 | IDFxm |
| Riske | BGxw2 | IDFxm |
| Riske | SBPSxc | IDFdk4 |
| Tatla_Little_Eagle | ESSFxv1 | MSxv |
| Tautri | MSxv | SBPSdc |
| Telegraph | ESSFxv1 | MSxv |
| Telegraph | IDFdw | SBPSxc |
| Tete_Angela | ESSFxv1 | MSxv |
| Tete_Angela | MSdv | MSxv |
| Tiedemann | ESSFxv1 | CWHds1 |
| Tiedemann | MHmm2 | CWHds1 |
| Tusulko | SBPSmc | SBPSxc |
| Twan | IDFxm | IDFdk3 |
| Twan | SBPSxc | SBPSdc |
| Upper_Big_Creek | SBPSxc | MSxv |
| Upper_Churn | SBPSxc | MSxv |
| Upper_Tatlayoko | IDFdw | IDFdk4 |
| Upper_Tatlayoko | MSdc2 | MSxv |
| Westbranch | MSdc2 | ESSFxv1 |
| Westbranch | MSxv | ESSFxv1 |
| Westbranch | SBPSxc | IDFdk4 |
| Williams_Lake | SBSdw2 | SBPSmk |

### A.4.12 Unsalvaged losses

Table A-38. shows the estimated (20-year) average annual unsalvaged volume loss to catastrophic events such as fires, wind and other epidemic agents over the long term on the timber harvesting land base. The total unsalvaged losses have been adjusted to reflect what was salvageable from the timber harvesting land base and reflect only the unrecovered volumes. These figures do not include volume adjustments to account for waste in the forest inventory operational discrepancy types (Section A.4.5.).

*Table A-38. Unsalvaged losses*

| Analysis unit | Cause of loss | Annual unsalvaged loss (cubic metres per year) |
|---|---|---|
| All | Fire | 25 653 |
| All | Insects | 16 297 |
| All | Wind | 11 550 |
| | Total | 53 500 |

Data source and comments:

A study of the protection information system (forest cover losses) was completed to determine the unsalvaged losses due to fire for the Williams Lake TSA from 1977 to 1996. Regional and district forest health officers examined records from 1992 to 1997 pertaining to the other loss agents mentioned above. The majority of the unsalvaged fire losses have occurred in the Chilcotin Forest District.

**The above losses do not include the total volume losses from mountain pine beetle,** currently estimated at close to 11 million cubic metres on over 300 000 hectares of timber harvesting land base. These losses were modelled explicitly in the base case with stand level information. Section A.4.6, "Mountain pine beetle attacked stands" provides a complete description of the assumptions used to model mountain pine beetle (MPB) attacked stands. Table A-39. shows the mountain pine beetle attacked stands with volume below the minimum merchantability thresholds (unsalvaged stands). It also shows the estimated loss of volume in stands remaining in the timber harvesting land base (salvage and potential sawlog).

*Table A-39. TSA level volume losses due to mountain pine beetle on pine stands*

| General description | Estimated total volume loss due to MPB | Estimated remaining volume | Timber harvesting land base[a] (hectares) |
|---|---|---|---|
| Unsalvaged stands | 3 816 371 | 2 033 119[b] | 90 424[c] |
| Salvage stands | 3 564 228 | 3 916 628 | 74 845 |
| Potential sawlog | 3 532 852 | 9 726 664 | 135 134 |
| Total | 10 913 450 | 15 226 411 | 300 453 |

(a) Area figures do not include a provision for wildlife tree patches.

(b) Additional volume potentially foregone as a result of these stands becoming unmerchantable.

(c) Total area currently unsalvageable but assumed to regenerate to the timber harvesting land base in the future.

# A.5 Volume Estimates

## A.5.1 Volume estimates for existing stands

The variable density yield prediction (VDYP) model, Version 6.5a developed and supported by the British Columbia Ministry of Forests, Resources Inventory Branch, was used to estimate timber volumes for existing natural stands. Table A-40. shows the volume estimates by analysis unit for existing natural stands. See Section A.2.2 for a complete description of analysis units.

*Table A-40. Volume estimates for existing natural stands (cubic metres/hectare)*

| Label | AS/B | APL_IDF | APL_Insect IDF | APL_SBPS | APL_Insect SBPS | APL_EM | BS/B |
|---|---|---|---|---|---|---|---|
| **a_unit** | **1102** | **1121** | **1129** | **1131** | **1139** | **1151** | **1202** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 50 | 0 | 4 | 1 | 3 | 1 | 5 | 1 |
| 60 | 1 | 14 | 6 | 12 | 5 | 17 | 5 |
| 70 | 5 | 28 | 16 | 25 | 14 | 34 | 13 |
| 80 | 14 | 42 | 26 | 39 | 24 | 53 | 28 |
| 90 | 31 | 56 | 36 | 53 | 33 | 72 | 48 |
| 100 | 52 | 70 | 46 | 66 | 42 | 90 | 72 |
| 110 | 75 | 83 | 55 | 79 | 51 | 107 | 97 |
| 120 | 97 | 95 | 64 | 91 | 60 | 124 | 120 |
| 130 | 118 | 107 | 72 | 103 | 68 | 140 | 143 |
| 140 | 138 | 116 | 78 | 112 | 74 | 151 | 163 |
| 150 | 155 | 123 | 83 | 119 | 79 | 161 | 181 |
| 160 | 171 | 129 | 87 | 124 | 83 | 169 | 197 |
| 170 | 185 | 133 | 90 | 128 | 85 | 175 | 212 |
| 180 | 198 | 135 | 91 | 131 | 87 | 178 | 225 |
| 190 | 210 | 136 | 92 | 132 | 88 | 180 | 237 |
| 200 | 221 | 138 | 93 | 134 | 89 | 183 | 248 |
| 210 | 232 | 140 | 95 | 136 | 91 | 186 | 258 |
| 220 | 242 | 142 | 97 | 138 | 92 | 189 | 268 |
| 230 | 251 | 145 | 98 | 140 | 94 | 192 | 277 |
| 240 | 259 | 146 | 99 | 142 | 95 | 195 | 286 |
| 250 | 267 | 148 | 101 | 144 | 96 | 198 | 294 |
| 260 | 274 | 150 | 102 | 145 | 97 | 200 | 301 |
| 270 | 281 | 151 | 103 | 147 | 98 | 202 | 307 |
| 280 | 287 | 152 | 103 | 148 | 99 | 204 | 313 |
| 290 | 293 | 154 | 104 | 149 | 100 | 205 | 319 |
| 300 | 298 | 155 | 105 | 150 | 101 | 207 | 324 |
| 310 | 303 | 155 | 106 | 151 | 101 | 208 | 329 |
| 320 | 308 | 156 | 106 | 152 | 102 | 209 | 334 |
| 330 | 312 | 157 | 107 | 152 | 102 | 210 | 338 |
| 340 | 316 | 157 | 107 | 153 | 103 | 211 | 341 |
| 350 | 319 | 158 | 107 | 153 | 103 | 211 | 345 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-40. Volume estimates for existing natural stands (cubic metres/hectare)*

| Label | BPL_IDF | BPL_Insect IDF | BPL_SBPS | BPL_Insect SBPS | BPL_SBS | BFD_SBS | BPL_EM |
|---|---|---|---|---|---|---|---|
| **a_unit** | **1221** | **1229** | **1231** | **1239** | **1241** | **1243** | **1251** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 12 | 1 | 0 |
| 40 | 1 | 0 | 2 | 0 | 43 | 11 | 0 |
| 50 | 10 | 1 | 6 | 2 | 82 | 36 | 2 |
| 60 | 24 | 9 | 17 | 10 | 119 | 63 | 12 |
| 70 | 40 | 20 | 33 | 21 | 152 | 91 | 30 |
| 80 | 56 | 30 | 48 | 31 | 182 | 117 | 50 |
| 90 | 70 | 40 | 63 | 42 | 210 | 142 | 69 |
| 100 | 85 | 50 | 77 | 52 | 235 | 167 | 88 |
| 110 | 98 | 59 | 90 | 61 | 258 | 189 | 106 |
| 120 | 111 | 68 | 103 | 70 | 279 | 209 | 123 |
| 130 | 123 | 77 | 115 | 79 | 300 | 228 | 140 |
| 140 | 132 | 83 | 124 | 85 | 313 | 244 | 152 |
| 150 | 139 | 88 | 131 | 91 | 324 | 259 | 162 |
| 160 | 144 | 92 | 137 | 95 | 333 | 272 | 170 |
| 170 | 148 | 95 | 141 | 97 | 338 | 284 | 176 |
| 180 | 150 | 96 | 143 | 99 | 340 | 295 | 180 |
| 190 | 151 | 97 | 144 | 100 | 340 | 305 | 181 |
| 200 | 153 | 98 | 146 | 101 | 343 | 315 | 185 |
| 210 | 155 | 100 | 148 | 103 | 346 | 325 | 188 |
| 220 | 157 | 101 | 150 | 104 | 349 | 334 | 191 |
| 230 | 159 | 103 | 152 | 106 | 352 | 343 | 194 |
| 240 | 161 | 104 | 154 | 107 | 355 | 352 | 197 |
| 250 | 163 | 106 | 156 | 108 | 357 | 360 | 199 |
| 260 | 165 | 107 | 157 | 109 | 359 | 360 | 202 |
| 270 | 166 | 108 | 159 | 110 | 361 | 360 | 204 |
| 280 | 167 | 108 | 160 | 111 | 363 | 361 | 206 |
| 290 | 168 | 109 | 161 | 112 | 365 | 361 | 207 |
| 300 | 169 | 110 | 162 | 113 | 366 | 361 | 209 |
| 310 | 170 | 110 | 163 | 114 | 367 | 361 | 210 |
| 320 | 171 | 111 | 164 | 114 | 369 | 361 | 211 |
| 330 | 171 | 111 | 165 | 115 | 370 | 361 | 212 |
| 340 | 172 | 112 | 165 | 115 | 371 | 361 | 213 |
| 350 | 172 | 112 | 165 | 115 | 371 | 361 | 214 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-40. Volume estimates for existing natural stands (cubic metres/hectare)*

| Label | AS/B | APL_IDF | APL_Insect IDF | APL_SBPS | APL_Insect SBPS | APL_EM | BS/B | BPL_IDF | BPL_Insect IDF |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **2102** | **2121** | **2129** | **2131** | **2139** | **2151** | **2202** | **2221** | **2229** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 40 | 0 | 3 | 0 | 2 | 0 | 2 | 5 | 10 | 1 |
| 50 | 3 | 12 | 3 | 8 | 3 | 11 | 26 | 27 | 5 |
| 60 | 9 | 27 | 12 | 22 | 13 | 28 | 65 | 48 | 17 |
| 70 | 23 | 43 | 23 | 37 | 24 | 48 | 104 | 67 | 29 |
| 80 | 45 | 59 | 34 | 53 | 35 | 68 | 140 | 85 | 41 |
| 90 | 71 | 75 | 44 | 68 | 45 | 87 | 174 | 102 | 52 |
| 100 | 97 | 90 | 54 | 83 | 55 | 106 | 204 | 118 | 63 |
| 110 | 121 | 104 | 64 | 97 | 64 | 124 | 231 | 134 | 73 |
| 120 | 144 | 117 | 73 | 110 | 73 | 140 | 255 | 148 | 82 |
| 130 | 165 | 130 | 81 | 122 | 82 | 157 | 277 | 162 | 91 |
| 140 | 184 | 139 | 87 | 131 | 88 | 168 | 295 | 171 | 98 |
| 150 | 201 | 146 | 92 | 139 | 93 | 178 | 310 | 179 | 103 |
| 160 | 216 | 152 | 96 | 144 | 97 | 185 | 323 | 184 | 107 |
| 170 | 229 | 156 | 99 | 148 | 100 | 190 | 334 | 188 | 110 |
| 180 | 241 | 158 | 100 | 150 | 101 | 193 | 343 | 190 | 111 |
| 190 | 251 | 158 | 101 | 150 | 102 | 193 | 351 | 190 | 112 |
| 200 | 261 | 160 | 102 | 152 | 103 | 196 | 359 | 192 | 113 |
| 210 | 270 | 162 | 104 | 154 | 104 | 198 | 366 | 194 | 115 |
| 220 | 278 | 164 | 105 | 156 | 106 | 201 | 372 | 196 | 116 |
| 230 | 286 | 166 | 106 | 158 | 107 | 204 | 378 | 198 | 118 |
| 240 | 293 | 168 | 108 | 160 | 108 | 206 | 383 | 200 | 119 |
| 250 | 300 | 169 | 109 | 162 | 110 | 208 | 388 | 202 | 120 |
| 260 | 306 | 171 | 110 | 163 | 111 | 210 | 392 | 203 | 122 |
| 270 | 311 | 172 | 111 | 165 | 112 | 212 | 396 | 205 | 122 |
| 280 | 316 | 173 | 112 | 166 | 113 | 214 | 399 | 206 | 123 |
| 290 | 320 | 174 | 113 | 167 | 113 | 215 | 402 | 207 | 124 |
| 300 | 325 | 175 | 113 | 168 | 114 | 216 | 404 | 208 | 125 |
| 310 | 328 | 176 | 114 | 169 | 115 | 217 | 407 | 209 | 125 |
| 320 | 332 | 177 | 114 | 169 | 115 | 218 | 409 | 210 | 126 |
| 330 | 335 | 177 | 115 | 170 | 116 | 219 | 411 | 210 | 126 |
| 340 | 338 | 178 | 115 | 170 | 116 | 220 | 412 | 211 | 127 |
| 350 | 340 | 178 | 115 | 171 | 116 | 220 | 414 | 211 | 127 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-40. Volume estimates for existing natural stands (cubic metres/hectare)*

| Label | BPL_SBPS | BPL_Insect SBPS | BPL_SBS | BFD_SBS | BPL_EM | DS/B | DC/H | DPL_SBPS | DPL_SBS |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **2231** | **2239** | **2241** | **2243** | **2251** | **2302** | **2307** | **2331** | **2341** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 1 | 0 | 13 | 4 | 0 | 0 | 2 | 14 | 32 |
| 40 | 9 | 0 | 55 | 33 | 2 | 9 | 23 | 50 | 87 |
| 50 | 24 | 7 | 98 | 70 | 8 | 38 | 53 | 84 | 137 |
| 60 | 44 | 20 | 137 | 107 | 25 | 77 | 89 | 114 | 180 |
| 70 | 64 | 33 | 172 | 143 | 44 | 115 | 127 | 141 | 218 |
| 80 | 82 | 45 | 203 | 177 | 63 | 149 | 161 | 164 | 252 |
| 90 | 99 | 57 | 231 | 209 | 82 | 180 | 184 | 186 | 282 |
| 100 | 115 | 68 | 257 | 239 | 101 | 208 | 202 | 206 | 310 |
| 110 | 131 | 79 | 281 | 267 | 118 | 233 | 214 | 224 | 335 |
| 120 | 146 | 89 | 303 | 290 | 135 | 254 | 222 | 240 | 358 |
| 130 | 159 | 99 | 324 | 312 | 152 | 274 | 239 | 255 | 379 |
| 140 | 169 | 106 | 338 | 331 | 164 | 292 | 255 | 266 | 393 |
| 150 | 177 | 112 | 349 | 348 | 173 | 307 | 270 | 273 | 404 |
| 160 | 182 | 116 | 357 | 362 | 181 | 319 | 284 | 279 | 412 |
| 170 | 186 | 119 | 362 | 375 | 186 | 330 | 296 | 281 | 416 |
| 180 | 188 | 120 | 364 | 386 | 188 | 340 | 307 | 282 | 417 |
| 190 | 188 | 120 | 363 | 397 | 189 | 349 | 318 | 281 | 415 |
| 200 | 189 | 122 | 366 | 407 | 192 | 357 | 328 | 282 | 417 |
| 210 | 191 | 123 | 369 | 417 | 195 | 365 | 338 | 283 | 420 |
| 220 | 193 | 125 | 372 | 426 | 197 | 372 | 348 | 285 | 422 |
| 230 | 195 | 126 | 375 | 435 | 200 | 379 | 358 | 287 | 424 |
| 240 | 197 | 128 | 377 | 443 | 202 | 385 | 368 | 288 | 427 |
| 250 | 199 | 129 | 380 | 451 | 204 | 391 | 377 | 290 | 429 |
| 260 | 200 | 130 | 382 | 451 | 206 | 394 | 380 | 291 | 431 |
| 270 | 202 | 131 | 384 | 452 | 208 | 396 | 382 | 292 | 433 |
| 280 | 203 | 132 | 386 | 452 | 210 | 399 | 384 | 293 | 434 |
| 290 | 204 | 133 | 387 | 453 | 211 | 401 | 385 | 294 | 436 |
| 300 | 205 | 134 | 389 | 453 | 213 | 403 | 387 | 295 | 437 |
| 310 | 206 | 134 | 390 | 453 | 214 | 405 | 388 | 296 | 439 |
| 320 | 207 | 135 | 391 | 453 | 215 | 407 | 390 | 297 | 440 |
| 330 | 207 | 135 | 392 | 453 | 215 | 408 | 391 | 297 | 441 |
| 340 | 208 | 136 | 393 | 453 | 216 | 409 | 392 | 298 | 442 |
| 350 | 208 | 136 | 394 | 453 | 216 | 411 | 393 | 298 | 442 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

# A.5 Volume Estimates

*Table A-40. Volume estimates for existing natural stands (cubic metres/hectare) (concluded)*

| Label | DFD_ SBS | DPL_ ESSF | DPL_ ICH | DFD_ ICH | APL_ Salvage3 +IDF | APL_ Salvage3 +SBPS | BPL_ Salvage3 +IDF | BPL_ Salvage3 +SBPS | BPA16 deciduous | DPA16 deciduous |
|---|---|---|---|---|---|---|---|---|---|---|
| a_unit | 2343 | 2351 | 2361 | 2363 | 2429 | 2439 | 2529 | 2539 | 8208 | 8308 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 3 | 14 | 18 | 3 | 0 | 0 | 0 | 0 | 1 | 6 |
| 40 | 31 | 55 | 62 | 20 | 0 | 1 | 0 | 0 | 10 | 29 |
| 50 | 70 | 99 | 105 | 49 | 3 | 5 | 1 | 1 | 23 | 57 |
| 60 | 110 | 139 | 144 | 84 | 10 | 13 | 8 | 7 | 39 | 82 |
| 70 | 148 | 175 | 179 | 120 | 19 | 22 | 17 | 16 | 56 | 106 |
| 80 | 184 | 206 | 210 | 154 | 27 | 30 | 25 | 24 | 70 | 125 |
| 90 | 217 | 235 | 238 | 185 | 35 | 38 | 33 | 32 | 83 | 142 |
| 100 | 247 | 262 | 264 | 213 | 43 | 46 | 40 | 40 | 94 | 156 |
| 110 | 274 | 286 | 287 | 238 | 50 | 53 | 48 | 47 | 103 | 167 |
| 120 | 297 | 308 | 309 | 260 | 57 | 60 | 55 | 55 | 110 | 177 |
| 130 | 319 | 329 | 329 | 282 | 63 | 67 | 61 | 62 | 116 | 183 |
| 140 | 339 | 343 | 343 | 302 | 68 | 72 | 66 | 67 | 121 | 189 |
| 150 | 356 | 355 | 354 | 319 | 72 | 76 | 70 | 71 | 125 | 194 |
| 160 | 371 | 363 | 362 | 335 | 75 | 79 | 73 | 74 | 127 | 196 |
| 170 | 384 | 368 | 367 | 349 | 77 | 81 | 75 | 76 | 129 | 197 |
| 180 | 397 | 370 | 369 | 362 | 78 | 82 | 77 | 77 | 130 | 198 |
| 190 | 408 | 369 | 368 | 374 | 79 | 82 | 77 | 78 | 131 | 199 |
| 200 | 419 | 372 | 370 | 386 | 80 | 83 | 78 | 79 | 132 | 200 |
| 210 | 430 | 375 | 373 | 398 | 81 | 84 | 79 | 80 | 133 | 201 |
| 220 | 440 | 377 | 376 | 409 | 82 | 86 | 80 | 81 | 134 | 202 |
| 230 | 450 | 380 | 379 | 419 | 83 | 87 | 81 | 82 | 135 | 203 |
| 240 | 459 | 383 | 382 | 429 | 84 | 88 | 83 | 83 | 136 | 204 |
| 250 | 467 | 385 | 384 | 439 | 85 | 89 | 83 | 84 | 136 | 204 |
| 260 | 468 | 387 | 386 | 441 | 86 | 90 | 84 | 85 | 137 | 205 |
| 270 | 469 | 389 | 388 | 442 | 87 | 90 | 85 | 86 | 137 | 205 |
| 280 | 470 | 391 | 389 | 443 | 87 | 91 | 86 | 87 | 138 | 206 |
| 290 | 471 | 393 | 391 | 445 | 88 | 92 | 87 | 88 | 138 | 206 |
| 300 | 472 | 394 | 392 | 446 | 89 | 92 | 87 | 88 | 139 | 206 |
| 310 | 472 | 395 | 393 | 447 | 89 | 93 | 88 | 89 | 139 | 207 |
| 320 | 473 | 396 | 394 | 448 | 90 | 93 | 88 | 89 | 139 | 207 |
| 330 | 473 | 397 | 395 | 449 | 90 | 94 | 88 | 90 | 140 | 207 |
| 340 | 474 | 398 | 396 | 450 | 90 | 94 | 89 | 90 | 140 | 207 |
| 350 | 474 | 399 | 396 | 450 | 90 | 94 | 89 | 90 | 140 | 208 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

# A.5 Volume Estimates

## A.5.2 Volume estimates for regenerated stands

Batch WinTIPSY (Windows™ version of the Table Interpolation Program for Stand Yields) version 3.0 alpha, supported by the British Columbia Ministry of Forests, Research Branch, was used to estimate growth and yield for existing and future managed stands. Existing managed stands were assumed to be all clearcut stands with an age of 34 years or less in the main TSA and 20 years of age or less in the western supply blocks. An area-weighted site index for each analysis unit combined with the regeneration assumptions listed in Table A-30. were used as inputs to TIPSY.

Table A-41. displays the volume tables for managed stands. These volume tables are generated from TIPSY for ages where TIPSY data exists, and estimated for ages beyond the TIPSY data set. Volumes are assumed to remain constant after 350 years of age.

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | AS/B | APL_IDF | APL_IDF | APL_ InsectIDF | APL_ InsectIDF | APL_ SBPS | APL_ SBPS | APL_ Insect SBPS | APL_ Insect SBPS |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **3102pg** | **3121n_** | **3121nt** | **3129n_** | **3129nt** | **3131n_** | **3131p_** | **3139n_** | **3139p_** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 50 | 0 | 2 | 4 | 2 | 3 | 2 | 4 | 1 | 2 |
| 60 | 1 | 12 | 18 | 10 | 14 | 11 | 15 | 9 | 12 |
| 70 | 4 | 26 | 33 | 22 | 29 | 24 | 32 | 19 | 26 |
| 80 | 20 | 43 | 51 | 37 | 45 | 40 | 49 | 34 | 43 |
| 90 | 47 | 63 | 72 | 56 | 65 | 59 | 73 | 50 | 64 |
| 100 | 79 | 83 | 92 | 74 | 83 | 77 | 96 | 70 | 86 |
| 110 | 113 | 102 | 111 | 92 | 100 | 96 | 118 | 86 | 106 |
| 120 | 149 | 120 | 128 | 110 | 117 | 115 | 139 | 104 | 126 |
| 130 | 178 | 137 | 142 | 124 | 132 | 129 | 157 | 118 | 144 |
| 140 | 206 | 151 | 156 | 140 | 146 | 145 | 173 | 134 | 160 |
| 150 | 232 | 162 | 168 | 151 | 157 | 156 | 186 | 146 | 175 |
| 160 | 259 | 174 | 179 | 161 | 167 | 167 | 198 | 157 | 185 |
| 170 | 285 | 182 | 189 | 172 | 178 | 178 | 209 | 166 | 196 |
| 180 | 307 | 191 | 198 | 180 | 187 | 186 | 218 | 175 | 207 |
| 190 | 324 | 198 | 206 | 189 | 195 | 192 | 228 | 184 | 217 |
| 200 | 341 | 207 | 211 | 194 | 202 | 200 | 237 | 190 | 224 |
| 210 | 351 | 211 | 216 | 202 | 206 | 208 | 242 | 197 | 233 |
| 220 | 362 | 216 | 223 | 206 | 212 | 211 | 246 | 203 | 239 |
| 230 | 370 | 221 | 227 | 212 | 217 | 215 | 251 | 205 | 241 |
| 240 | 377 | 225 | 232 | 214 | 220 | 218 | 254 | 208 | 245 |
| 250 | 383 | 229 | 236 | 218 | 226 | 222 | 258 | 211 | 249 |
| 260 | 389 | 232 | 237 | 222 | 228 | 225 | 260 | 214 | 252 |
| 270 | 392 | 235 | 243 | 225 | 231 | 229 | 263 | 219 | 253 |
| 280 | 397 | 237 | 243 | 226 | 234 | 230 | 266 | 220 | 257 |
| 290 | 400 | 238 | 246 | 229 | 235 | 233 | 268 | 222 | 258 |
| 300 | 400 | 238 | 246 | 231 | 238 | 233 | 268 | 223 | 258 |
| 310 | 400 | 238 | 246 | 231 | 238 | 233 | 268 | 223 | 258 |
| 320 | 400 | 238 | 246 | 231 | 238 | 233 | 268 | 223 | 258 |
| 330 | 400 | 238 | 246 | 231 | 238 | 233 | 268 | 223 | 258 |
| 340 | 400 | 238 | 246 | 231 | 238 | 233 | 268 | 223 | 258 |
| 350 | 400 | 238 | 246 | 231 | 238 | 233 | 268 | 223 | 258 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | APL_EM | APL_EM | BS/B | BPL_IDF | BPL_IDF | BPL_Insect IDF | BPL_Insect IDF | BPL_ SBPS | BPL_ SBPS |
|---|---|---|---|---|---|---|---|---|---|
| a_unit | 3151n_ | 3151p_ | 3202pg | 3221n_ | 3221nt | 3229n_ | 3229nt | 3231n_ | 3231p_ |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 1 |
| 50 | 1 | 3 | 0 | 11 | 15 | 3 | 4 | 5 | 9 |
| 60 | 9 | 14 | 3 | 27 | 35 | 13 | 19 | 16 | 24 |
| 70 | 20 | 29 | 18 | 49 | 59 | 27 | 35 | 35 | 44 |
| 80 | 34 | 47 | 49 | 75 | 84 | 45 | 54 | 57 | 71 |
| 90 | 53 | 70 | 86 | 101 | 109 | 65 | 75 | 78 | 97 |
| 100 | 71 | 93 | 127 | 124 | 131 | 85 | 96 | 101 | 123 |
| 110 | 93 | 115 | 166 | 146 | 151 | 106 | 113 | 121 | 145 |
| 120 | 111 | 134 | 197 | 164 | 171 | 123 | 130 | 139 | 166 |
| 130 | 129 | 152 | 230 | 180 | 185 | 139 | 146 | 155 | 183 |
| 140 | 146 | 169 | 261 | 195 | 200 | 153 | 158 | 168 | 199 |
| 150 | 160 | 181 | 290 | 206 | 213 | 165 | 170 | 181 | 212 |
| 160 | 173 | 194 | 315 | 218 | 224 | 176 | 183 | 193 | 225 |
| 170 | 185 | 205 | 337 | 228 | 233 | 186 | 191 | 201 | 235 |
| 180 | 194 | 214 | 352 | 236 | 242 | 194 | 200 | 209 | 245 |
| 190 | 205 | 224 | 366 | 243 | 250 | 203 | 208 | 217 | 253 |
| 200 | 214 | 232 | 377 | 248 | 257 | 209 | 214 | 223 | 258 |
| 210 | 220 | 238 | 385 | 254 | 262 | 215 | 221 | 229 | 265 |
| 220 | 225 | 244 | 392 | 260 | 266 | 220 | 225 | 232 | 269 |
| 230 | 230 | 247 | 399 | 263 | 269 | 223 | 232 | 237 | 274 |
| 240 | 235 | 251 | 403 | 268 | 272 | 228 | 235 | 243 | 278 |
| 250 | 241 | 255 | 408 | 270 | 276 | 232 | 238 | 246 | 279 |
| 260 | 243 | 258 | 413 | 271 | 279 | 235 | 241 | 247 | 281 |
| 270 | 246 | 259 | 415 | 274 | 282 | 239 | 246 | 247 | 282 |
| 280 | 249 | 263 | 418 | 278 | 287 | 239 | 246 | 248 | 283 |
| 290 | 252 | 264 | 418 | 281 | 288 | 239 | 247 | 250 | 283 |
| 300 | 253 | 264 | 418 | 281 | 290 | 241 | 246 | 250 | 283 |
| 310 | 253 | 264 | 418 | 281 | 290 | 241 | 246 | 250 | 283 |
| 320 | 253 | 264 | 418 | 281 | 290 | 241 | 246 | 250 | 283 |
| 330 | 253 | 264 | 418 | 281 | 290 | 241 | 246 | 250 | 283 |
| 340 | 253 | 264 | 418 | 281 | 290 | 241 | 246 | 250 | 283 |
| 350 | 253 | 264 | 418 | 281 | 290 | 241 | 246 | 250 | 283 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | BPL_ Insect SBPS | BPL_ Insect SBPS | BPL_SBS | BPL_SBS | BPL_SBS | BPL_SBS | BFD_SBS | BFD_SBS | BFD_SBS |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **3239n_** | **3239p_** | **3241n_** | **3241nt** | **3241p_** | **3241pt** | **3243n_** | **3243nt** | **3243p_** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 4 | 8 | 10 | 15 | 4 | 7 | 9 |
| 40 | 0 | 1 | 34 | 42 | 50 | 59 | 28 | 35 | 46 |
| 50 | 4 | 8 | 84 | 92 | 110 | 118 | 73 | 82 | 104 |
| 60 | 15 | 21 | 136 | 143 | 167 | 174 | 126 | 134 | 158 |
| 70 | 31 | 40 | 183 | 187 | 217 | 225 | 176 | 181 | 205 |
| 80 | 50 | 66 | 221 | 227 | 256 | 264 | 223 | 227 | 244 |
| 90 | 73 | 90 | 255 | 262 | 290 | 299 | 261 | 264 | 279 |
| 100 | 95 | 115 | 283 | 292 | 320 | 330 | 293 | 300 | 311 |
| 110 | 115 | 138 | 309 | 317 | 341 | 353 | 321 | 325 | 332 |
| 120 | 131 | 157 | 326 | 335 | 355 | 369 | 343 | 351 | 350 |
| 130 | 149 | 176 | 341 | 351 | 368 | 381 | 361 | 369 | 366 |
| 140 | 161 | 190 | 357 | 364 | 376 | 391 | 379 | 387 | 379 |
| 150 | 173 | 204 | 364 | 376 | 386 | 402 | 393 | 404 | 390 |
| 160 | 186 | 216 | 376 | 385 | 392 | 408 | 406 | 416 | 403 |
| 170 | 194 | 228 | 383 | 395 | 398 | 416 | 416 | 427 | 414 |
| 180 | 203 | 238 | 391 | 403 | 405 | 422 | 426 | 436 | 420 |
| 190 | 210 | 245 | 399 | 409 | 408 | 426 | 431 | 444 | 428 |
| 200 | 216 | 252 | 402 | 414 | 411 | 429 | 438 | 450 | 432 |
| 210 | 221 | 258 | 405 | 419 | 412 | 431 | 443 | 454 | 435 |
| 220 | 227 | 262 | 407 | 419 | 413 | 432 | 446 | 458 | 440 |
| 230 | 230 | 266 | 408 | 422 | 413 | 431 | 450 | 462 | 444 |
| 240 | 237 | 271 | 410 | 421 | 411 | 431 | 455 | 466 | 445 |
| 250 | 240 | 274 | 409 | 424 | 412 | 429 | 457 | 471 | 448 |
| 260 | 242 | 278 | 411 | 423 | 414 | 431 | 458 | 471 | 450 |
| 270 | 244 | 278 | 412 | 428 | 412 | 430 | 460 | 474 | 453 |
| 280 | 243 | 277 | 414 | 425 | 414 | 431 | 461 | 474 | 453 |
| 290 | 245 | 278 | 413 | 427 | 412 | 430 | 465 | 475 | 455 |
| 300 | 245 | 278 | 414 | 427 | 412 | 430 | 467 | 478 | 455 |
| 310 | 245 | 278 | 414 | 427 | 412 | 430 | 467 | 478 | 455 |
| 320 | 245 | 278 | 414 | 427 | 412 | 430 | 467 | 478 | 455 |
| 330 | 245 | 278 | 414 | 427 | 412 | 430 | 467 | 478 | 455 |
| 340 | 245 | 278 | 414 | 427 | 412 | 430 | 467 | 478 | 455 |
| 350 | 245 | 278 | 414 | 427 | 412 | 430 | 467 | 478 | 455 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | BFD_SBS | BPL_EM | BPL_EM | DS/B | DC/H | DC/H | DPL_SBPS | DPL_SBPS | DPL_SBS |
|---|---|---|---|---|---|---|---|---|---|
| a_unit | 3243pt | 3251n_ | 3251p_ | 3302pg | 3307p_ | 3307pt | 3331n_ | 3331p_ | 3341n_ |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 30 | 13 | 0 | 0 | 0 | 2 | 2 | 20 | 38 | 15 |
| 40 | 54 | 0 | 0 | 2 | 16 | 19 | 84 | 114 | 71 |
| 50 | 112 | 1 | 2 | 16 | 51 | 55 | 154 | 190 | 137 |
| 60 | 164 | 7 | 12 | 57 | 99 | 104 | 217 | 254 | 198 |
| 70 | 211 | 15 | 24 | 114 | 146 | 149 | 270 | 305 | 250 |
| 80 | 253 | 29 | 41 | 170 | 190 | 191 | 313 | 343 | 296 |
| 90 | 288 | 45 | 61 | 220 | 224 | 228 | 344 | 371 | 328 |
| 100 | 318 | 63 | 83 | 265 | 256 | 259 | 370 | 392 | 355 |
| 110 | 341 | 81 | 103 | 312 | 284 | 290 | 392 | 411 | 377 |
| 120 | 362 | 100 | 122 | 347 | 310 | 316 | 409 | 423 | 396 |
| 130 | 377 | 117 | 140 | 376 | 329 | 337 | 422 | 433 | 412 |
| 140 | 393 | 133 | 155 | 395 | 347 | 353 | 432 | 441 | 425 |
| 150 | 405 | 149 | 171 | 410 | 359 | 366 | 441 | 453 | 435 |
| 160 | 418 | 162 | 182 | 423 | 368 | 377 | 447 | 456 | 444 |
| 170 | 428 | 173 | 192 | 432 | 380 | 388 | 453 | 458 | 450 |
| 180 | 433 | 183 | 203 | 441 | 387 | 397 | 457 | 461 | 454 |
| 190 | 441 | 193 | 212 | 449 | 395 | 405 | 458 | 462 | 457 |
| 200 | 448 | 202 | 221 | 455 | 403 | 412 | 460 | 462 | 461 |
| 210 | 450 | 211 | 229 | 458 | 408 | 416 | 460 | 464 | 463 |
| 220 | 454 | 216 | 235 | 460 | 413 | 424 | 463 | 463 | 467 |
| 230 | 457 | 221 | 239 | 465 | 416 | 428 | 464 | 464 | 467 |
| 240 | 462 | 225 | 241 | 464 | 420 | 429 | 465 | 465 | 469 |
| 250 | 462 | 230 | 245 | 464 | 422 | 436 | 465 | 465 | 469 |
| 260 | 465 | 234 | 249 | 462 | 426 | 437 | 465 | 465 | 471 |
| 270 | 469 | 237 | 251 | 460 | 428 | 439 | 465 | 465 | 472 |
| 280 | 468 | 239 | 252 | 459 | 430 | 441 | 465 | 465 | 473 |
| 290 | 470 | 242 | 254 | 457 | 431 | 441 | 465 | 465 | 473 |
| 300 | 470 | 243 | 254 | 457 | 431 | 441 | 465 | 465 | 473 |
| 310 | 470 | 243 | 254 | 457 | 431 | 441 | 465 | 465 | 473 |
| 320 | 470 | 243 | 254 | 457 | 431 | 441 | 465 | 465 | 473 |
| 330 | 470 | 243 | 254 | 457 | 431 | 441 | 465 | 465 | 473 |
| 340 | 470 | 243 | 254 | 457 | 431 | 441 | 465 | 465 | 473 |
| 350 | 470 | 243 | 254 | 457 | 431 | 441 | 465 | 465 | 473 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | DPL_SBS | DPL_SBS | DPL_SBS | DFD_SBS | DFD_SBS | DFD_SBS | DFD_SBS | DPL_ESSF | DPL_ESSF |
|---|---|---|---|---|---|---|---|---|---|
| a_unit | 3341nt | 3341p_ | 3341pt | 3343n_ | 3343nt | 3343p_ | 3343pt | 3351n_ | 3351p_ |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 |
| 30 | 22 | 29 | 37 | 6 | 10 | 13 | 19 | 5 | 14 |
| 40 | 79 | 98 | 108 | 37 | 43 | 58 | 67 | 35 | 58 |
| 50 | 144 | 173 | 181 | 87 | 96 | 121 | 129 | 84 | 120 |
| 60 | 204 | 237 | 244 | 143 | 151 | 176 | 184 | 137 | 176 |
| 70 | 257 | 289 | 297 | 196 | 201 | 226 | 232 | 187 | 225 |
| 80 | 303 | 329 | 341 | 244 | 248 | 268 | 274 | 231 | 263 |
| 90 | 336 | 359 | 370 | 282 | 289 | 302 | 312 | 267 | 297 |
| 100 | 364 | 381 | 395 | 315 | 320 | 329 | 339 | 298 | 327 |
| 110 | 389 | 400 | 415 | 343 | 350 | 350 | 362 | 323 | 347 |
| 120 | 409 | 411 | 430 | 365 | 373 | 369 | 383 | 342 | 360 |
| 130 | 425 | 424 | 441 | 384 | 394 | 385 | 400 | 357 | 374 |
| 140 | 438 | 434 | 453 | 400 | 411 | 401 | 416 | 370 | 380 |
| 150 | 448 | 440 | 460 | 415 | 426 | 415 | 429 | 380 | 390 |
| 160 | 459 | 446 | 469 | 428 | 438 | 426 | 439 | 388 | 398 |
| 170 | 468 | 453 | 472 | 437 | 449 | 433 | 448 | 397 | 404 |
| 180 | 471 | 453 | 473 | 448 | 458 | 440 | 457 | 403 | 409 |
| 190 | 473 | 453 | 475 | 453 | 466 | 448 | 462 | 411 | 413 |
| 200 | 478 | 456 | 475 | 458 | 472 | 453 | 469 | 411 | 416 |
| 210 | 480 | 454 | 474 | 464 | 476 | 456 | 472 | 415 | 415 |
| 220 | 479 | 456 | 475 | 468 | 481 | 461 | 475 | 414 | 415 |
| 230 | 481 | 456 | 474 | 471 | 484 | 463 | 477 | 416 | 417 |
| 240 | 483 | 457 | 474 | 473 | 483 | 462 | 480 | 418 | 416 |
| 250 | 484 | 456 | 475 | 474 | 484 | 464 | 479 | 417 | 416 |
| 260 | 487 | 456 | 475 | 474 | 485 | 465 | 480 | 417 | 416 |
| 270 | 486 | 456 | 476 | 474 | 485 | 466 | 480 | 419 | 419 |
| 280 | 488 | 455 | 474 | 474 | 486 | 465 | 479 | 418 | 418 |
| 290 | 488 | 455 | 474 | 473 | 485 | 466 | 479 | 419 | 418 |
| 300 | 488 | 455 | 474 | 474 | 484 | 466 | 479 | 417 | 418 |
| 310 | 488 | 455 | 474 | 474 | 484 | 466 | 479 | 417 | 418 |
| 320 | 488 | 455 | 474 | 474 | 484 | 466 | 479 | 417 | 418 |
| 330 | 488 | 455 | 474 | 474 | 484 | 466 | 479 | 417 | 418 |
| 340 | 488 | 455 | 474 | 474 | 484 | 466 | 479 | 417 | 418 |
| 350 | 488 | 455 | 474 | 474 | 484 | 466 | 479 | 417 | 418 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | DPL_ICH | DPL_ICH | DFD_ICH | DFD_ICH | APL_ Salvage3+ IDF | APL_ Salvage3+ IDF | APL_ Salvage3+ SBPS | APL_ Salvage3+ SBPS | BPL_ Salvage3+ IDF |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **3361p_** | **3361pt** | **3363p_** | **3363pt** | **3429n_** | **3429nt** | **3439n_** | **3439p_** | **3529n_** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 17 | 23 | 4 | 5 | 0 | 0 | 0 | 0 | 0 |
| 40 | 67 | 75 | 24 | 31 | 0 | 0 | 0 | 0 | 0 |
| 50 | 135 | 143 | 67 | 75 | 1 | 2 | 1 | 2 | 2 |
| 60 | 197 | 203 | 116 | 124 | 5 | 9 | 6 | 9 | 12 |
| 70 | 248 | 255 | 159 | 165 | 14 | 20 | 15 | 21 | 26 |
| 80 | 291 | 299 | 197 | 203 | 26 | 34 | 29 | 36 | 43 |
| 90 | 328 | 337 | 231 | 235 | 40 | 48 | 43 | 55 | 63 |
| 100 | 352 | 366 | 259 | 264 | 58 | 66 | 61 | 76 | 83 |
| 110 | 373 | 386 | 283 | 291 | 73 | 83 | 77 | 96 | 102 |
| 120 | 388 | 403 | 305 | 314 | 90 | 98 | 93 | 114 | 120 |
| 130 | 402 | 417 | 321 | 328 | 103 | 112 | 108 | 132 | 137 |
| 140 | 414 | 431 | 333 | 343 | 118 | 124 | 122 | 148 | 151 |
| 150 | 424 | 443 | 343 | 356 | 131 | 138 | 135 | 163 | 162 |
| 160 | 432 | 450 | 354 | 367 | 142 | 147 | 146 | 174 | 174 |
| 170 | 438 | 456 | 363 | 375 | 150 | 158 | 155 | 186 | 182 |
| 180 | 443 | 463 | 370 | 382 | 161 | 165 | 164 | 195 | 191 |
| 190 | 448 | 465 | 376 | 390 | 167 | 173 | 173 | 204 | 198 |
| 200 | 450 | 468 | 386 | 395 | 175 | 181 | 179 | 214 | 207 |
| 210 | 452 | 473 | 391 | 402 | 181 | 188 | 186 | 221 | 211 |
| 220 | 454 | 472 | 395 | 407 | 188 | 194 | 191 | 228 | 216 |
| 230 | 453 | 471 | 397 | 411 | 192 | 198 | 197 | 234 | 221 |
| 240 | 452 | 469 | 403 | 414 | 196 | 201 | 200 | 235 | 225 |
| 250 | 449 | 469 | 406 | 417 | 200 | 204 | 203 | 239 | 229 |
| 260 | 452 | 469 | 408 | 419 | 201 | 208 | 204 | 242 | 232 |
| 270 | 451 | 468 | 406 | 419 | 204 | 210 | 209 | 245 | 235 |
| 280 | 450 | 466 | 407 | 419 | 207 | 213 | 211 | 247 | 237 |
| 290 | 448 | 465 | 406 | 418 | 210 | 214 | 213 | 248 | 238 |
| 300 | 448 | 465 | 406 | 418 | 211 | 217 | 213 | 248 | 238 |
| 310 | 448 | 465 | 406 | 418 | 211 | 217 | 213 | 248 | 238 |
| 320 | 448 | 465 | 406 | 418 | 211 | 217 | 213 | 248 | 238 |
| 330 | 448 | 465 | 406 | 418 | 211 | 217 | 213 | 248 | 238 |
| 340 | 448 | 465 | 406 | 418 | 211 | 217 | 213 | 248 | 238 |
| 350 | 448 | 465 | 406 | 418 | 211 | 217 | 213 | 248 | 238 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

# A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | BPL_Salvage3 +IDF | BPL_Salvage3 +SBPS | BPL_Salvage3 +SBPS |
|---|---|---|---|
| **a_unit** | **3529nt** | **3539n_** | **3539p_** |
| 10 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 40 | 1 | 0 | 0 |
| 50 | 4 | 1 | 2 |
| 60 | 18 | 5 | 8 |
| 70 | 33 | 13 | 17 |
| 80 | 51 | 26 | 33 |
| 90 | 72 | 40 | 49 |
| 100 | 92 | 54 | 69 |
| 110 | 111 | 72 | 89 |
| 120 | 128 | 86 | 106 |
| 130 | 142 | 101 | 123 |
| 140 | 156 | 114 | 140 |
| 150 | 168 | 128 | 154 |
| 160 | 179 | 139 | 168 |
| 170 | 189 | 148 | 179 |
| 180 | 198 | 156 | 188 |
| 190 | 206 | 166 | 196 |
| 200 | 211 | 171 | 205 |
| 210 | 216 | 178 | 214 |
| 220 | 223 | 184 | 221 |
| 230 | 227 | 190 | 227 |
| 240 | 232 | 195 | 231 |
| 250 | 236 | 199 | 234 |
| 260 | 237 | 199 | 237 |
| 270 | 243 | 202 | 238 |
| 280 | 243 | 206 | 240 |
| 290 | 246 | 206 | 242 |
| 300 | 246 | 209 | 242 |
| 310 | 246 | 209 | 242 |
| 320 | 246 | 209 | 242 |
| 330 | 246 | 209 | 242 |
| 340 | 246 | 209 | 242 |
| 350 | 246 | 209 | 242 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41.* *Volume estimates for managed stands (cubic metres/hectare)*

| Label | AS/B | AS/B | APL_IDF | APL_IDF | APL_ InsectIDF | APL_ InsectIDF | APL_ SBPS | APL_ SBPS | APL_ InsectSBPS |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **4102p_** | **4102pg** | **4121n_** | **4121nt** | **4129n_** | **4129nt** | **4131n_** | **4131p_** | **4139n_** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 2 | 1 |
| 50 | 2 | 2 | 9 | 13 | 6 | 9 | 7 | 11 | 6 |
| 60 | 9 | 11 | 25 | 31 | 18 | 25 | 21 | 29 | 20 |
| 70 | 34 | 39 | 45 | 54 | 35 | 45 | 40 | 51 | 39 |
| 80 | 73 | 79 | 70 | 79 | 58 | 66 | 64 | 80 | 62 |
| 90 | 113 | 121 | 95 | 103 | 79 | 88 | 87 | 108 | 85 |
| 100 | 157 | 165 | 118 | 125 | 102 | 110 | 109 | 133 | 106 |
| 110 | 194 | 203 | 138 | 145 | 121 | 130 | 130 | 157 | 127 |
| 120 | 227 | 236 | 157 | 163 | 141 | 146 | 149 | 177 | 147 |
| 130 | 261 | 273 | 174 | 179 | 157 | 162 | 164 | 193 | 162 |
| 140 | 294 | 305 | 188 | 194 | 170 | 176 | 179 | 208 | 175 |
| 150 | 322 | 328 | 199 | 206 | 183 | 189 | 193 | 223 | 188 |
| 160 | 345 | 352 | 210 | 216 | 194 | 200 | 202 | 235 | 198 |
| 170 | 363 | 368 | 219 | 227 | 203 | 208 | 211 | 246 | 208 |
| 180 | 376 | 381 | 228 | 234 | 211 | 218 | 220 | 255 | 215 |
| 190 | 387 | 392 | 236 | 241 | 220 | 225 | 226 | 264 | 224 |
| 200 | 397 | 402 | 242 | 249 | 226 | 230 | 233 | 269 | 230 |
| 210 | 405 | 408 | 248 | 253 | 231 | 237 | 238 | 275 | 236 |
| 220 | 412 | 415 | 254 | 260 | 235 | 243 | 243 | 280 | 241 |
| 230 | 418 | 420 | 255 | 263 | 242 | 247 | 249 | 282 | 246 |
| 240 | 421 | 425 | 259 | 266 | 245 | 252 | 251 | 285 | 249 |
| 250 | 426 | 429 | 261 | 270 | 247 | 254 | 253 | 286 | 250 |
| 260 | 429 | 432 | 264 | 273 | 250 | 255 | 254 | 288 | 251 |
| 270 | 430 | 433 | 268 | 275 | 252 | 257 | 256 | 291 | 252 |
| 280 | 431 | 434 | 270 | 277 | 251 | 259 | 257 | 292 | 255 |
| 290 | 432 | 435 | 273 | 280 | 254 | 261 | 258 | 292 | 255 |
| 300 | 432 | 435 | 275 | 283 | 256 | 265 | 260 | 292 | 257 |
| 310 | 432 | 435 | 275 | 283 | 256 | 265 | 260 | 292 | 257 |
| 320 | 432 | 435 | 275 | 283 | 256 | 265 | 260 | 292 | 257 |
| 330 | 432 | 435 | 275 | 283 | 256 | 265 | 260 | 292 | 257 |
| 340 | 432 | 435 | 275 | 283 | 256 | 265 | 260 | 292 | 257 |
| 350 | 432 | 435 | 275 | 283 | 256 | 265 | 260 | 292 | 257 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

# A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | APL_ Insect SBPS | APL_EM | APL_EM | BS/B | BS/B | BPL_IDF | BPL_IDF | BPL_ InsectIDF | BPL_ InsectIDF |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **4139p_** | **4151n_** | **4151p_** | **4202p_** | **4202pg** | **4221n_** | **4221nt** | **4229n_** | **4229nt** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 40 | 1 | 1 | 1 | 14 | 22 | 9 | 13 | 1 | 2 |
| 50 | 10 | 5 | 10 | 64 | 88 | 30 | 40 | 9 | 13 |
| 60 | 28 | 16 | 25 | 134 | 169 | 64 | 72 | 25 | 31 |
| 70 | 49 | 33 | 46 | 204 | 238 | 99 | 108 | 45 | 54 |
| 80 | 77 | 55 | 74 | 264 | 306 | 133 | 141 | 70 | 79 |
| 90 | 105 | 76 | 101 | 325 | 364 | 163 | 169 | 95 | 103 |
| 100 | 130 | 100 | 126 | 370 | 401 | 189 | 195 | 118 | 125 |
| 110 | 152 | 123 | 148 | 401 | 428 | 212 | 216 | 138 | 145 |
| 120 | 173 | 145 | 169 | 425 | 449 | 230 | 237 | 157 | 163 |
| 130 | 191 | 162 | 186 | 444 | 465 | 247 | 252 | 174 | 179 |
| 140 | 206 | 179 | 201 | 459 | 479 | 262 | 270 | 188 | 194 |
| 150 | 219 | 194 | 215 | 470 | 488 | 274 | 281 | 199 | 206 |
| 160 | 232 | 205 | 228 | 480 | 495 | 286 | 293 | 210 | 216 |
| 170 | 242 | 217 | 239 | 485 | 497 | 295 | 305 | 219 | 227 |
| 180 | 252 | 227 | 249 | 493 | 497 | 305 | 311 | 228 | 234 |
| 190 | 259 | 236 | 254 | 496 | 497 | 309 | 317 | 236 | 241 |
| 200 | 265 | 242 | 262 | 494 | 496 | 314 | 322 | 242 | 249 |
| 210 | 270 | 249 | 267 | 493 | 496 | 318 | 327 | 248 | 253 |
| 220 | 274 | 255 | 272 | 493 | 496 | 322 | 331 | 254 | 260 |
| 230 | 282 | 261 | 276 | 491 | 495 | 324 | 334 | 255 | 263 |
| 240 | 283 | 265 | 282 | 490 | 492 | 328 | 338 | 259 | 266 |
| 250 | 283 | 268 | 283 | 487 | 490 | 331 | 339 | 261 | 270 |
| 260 | 285 | 270 | 282 | 485 | 489 | 335 | 342 | 264 | 273 |
| 270 | 287 | 271 | 283 | 484 | 485 | 336 | 346 | 268 | 275 |
| 280 | 288 | 274 | 285 | 483 | 481 | 337 | 348 | 270 | 277 |
| 290 | 290 | 274 | 287 | 481 | 478 | 336 | 344 | 273 | 280 |
| 300 | 290 | 276 | 287 | 481 | 478 | 334 | 341 | 275 | 283 |
| 310 | 290 | 276 | 287 | 481 | 478 | 334 | 341 | 275 | 283 |
| 320 | 290 | 276 | 287 | 481 | 478 | 334 | 341 | 275 | 283 |
| 330 | 290 | 276 | 287 | 481 | 478 | 334 | 341 | 275 | 283 |
| 340 | 290 | 276 | 287 | 481 | 478 | 334 | 341 | 275 | 283 |
| 350 | 290 | 276 | 287 | 481 | 478 | 334 | 341 | 275 | 283 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | BPL_ SBPS | BPL_ SBPS | BPL_ Insect SBPS | BPL_ Insect SBPS | BPL_SBS | BPL_SBS | BPL_SBS | BPL_SBS | BFD_SBS |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **4231n_** | **4231p_** | **4239n_** | **4239p_** | **4241n_** | **4241nt** | **4241p_** | **4241pt** | **4243n_** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 30 | 0 | 1 | 0 | 0 | 11 | 16 | 20 | 27 | 15 |
| 40 | 5 | 10 | 1 | 2 | 56 | 64 | 77 | 86 | 62 |
| 50 | 24 | 35 | 12 | 17 | 116 | 124 | 149 | 156 | 129 |
| 60 | 52 | 69 | 30 | 39 | 174 | 180 | 211 | 217 | 193 |
| 70 | 86 | 108 | 53 | 69 | 223 | 229 | 260 | 267 | 254 |
| 80 | 118 | 144 | 79 | 99 | 265 | 273 | 300 | 311 | 302 |
| 90 | 147 | 174 | 106 | 130 | 302 | 310 | 334 | 346 | 341 |
| 100 | 174 | 202 | 129 | 155 | 329 | 337 | 358 | 372 | 376 |
| 110 | 195 | 225 | 151 | 179 | 351 | 360 | 374 | 390 | 402 |
| 120 | 213 | 242 | 170 | 198 | 369 | 378 | 390 | 405 | 424 |
| 130 | 229 | 262 | 185 | 216 | 385 | 395 | 402 | 418 | 443 |
| 140 | 242 | 277 | 201 | 231 | 400 | 410 | 412 | 430 | 461 |
| 150 | 255 | 290 | 211 | 243 | 408 | 423 | 421 | 439 | 474 |
| 160 | 266 | 300 | 222 | 256 | 419 | 431 | 426 | 443 | 483 |
| 170 | 276 | 309 | 232 | 266 | 424 | 438 | 430 | 450 | 491 |
| 180 | 283 | 315 | 239 | 277 | 432 | 445 | 435 | 453 | 500 |
| 190 | 291 | 324 | 246 | 281 | 434 | 451 | 438 | 460 | 505 |
| 200 | 297 | 327 | 253 | 287 | 441 | 455 | 440 | 460 | 512 |
| 210 | 302 | 331 | 258 | 292 | 443 | 460 | 441 | 463 | 516 |
| 220 | 303 | 332 | 263 | 297 | 447 | 460 | 442 | 462 | 516 |
| 230 | 306 | 335 | 266 | 299 | 446 | 462 | 439 | 459 | 516 |
| 240 | 307 | 334 | 268 | 299 | 445 | 460 | 438 | 459 | 516 |
| 250 | 309 | 337 | 271 | 305 | 443 | 458 | 437 | 456 | 516 |
| 260 | 311 | 337 | 274 | 307 | 444 | 459 | 434 | 454 | 516 |
| 270 | 312 | 337 | 277 | 309 | 445 | 459 | 433 | 452 | 516 |
| 280 | 313 | 339 | 278 | 312 | 442 | 457 | 434 | 451 | 516 |
| 290 | 314 | 341 | 283 | 315 | 440 | 457 | 432 | 449 | 516 |
| 300 | 315 | 341 | 285 | 315 | 442 | 457 | 432 | 449 | 516 |
| 310 | 315 | 341 | 285 | 315 | 442 | 457 | 432 | 449 | 516 |
| 320 | 315 | 341 | 285 | 315 | 442 | 457 | 432 | 449 | 516 |
| 330 | 315 | 341 | 285 | 315 | 442 | 457 | 432 | 449 | 516 |
| 340 | 315 | 341 | 285 | 315 | 442 | 457 | 432 | 449 | 516 |
| 350 | 315 | 341 | 285 | 315 | 442 | 457 | 432 | 449 | 516 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | BFD_SBS | BFD_SBS | BFD_SBS | BPL_EM | BPL_EM | DS/B | DS/B | DC/H | DC/H |
|---|---|---|---|---|---|---|---|---|---|
| a_unit | 4243nt | 4243p_ | 4243pt | 4251n_ | 4251p_ | 4302p_ | 4302pg | 4307p_ | 4307pt |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 20 | 27 | 34 | 0 | 0 | 1 | 1 | 4 | 5 |
| 40 | 70 | 97 | 105 | 0 | 1 | 17 | 24 | 25 | 29 |
| 50 | 136 | 167 | 175 | 3 | 8 | 73 | 94 | 70 | 76 |
| 60 | 200 | 229 | 235 | 13 | 21 | 149 | 175 | 125 | 129 |
| 70 | 259 | 281 | 289 | 29 | 41 | 218 | 247 | 173 | 178 |
| 80 | 307 | 321 | 331 | 46 | 65 | 278 | 314 | 217 | 221 |
| 90 | 349 | 355 | 365 | 69 | 91 | 339 | 370 | 254 | 258 |
| 100 | 383 | 383 | 397 | 91 | 115 | 384 | 406 | 290 | 292 |
| 110 | 411 | 406 | 420 | 113 | 137 | 413 | 434 | 317 | 322 |
| 120 | 437 | 425 | 441 | 134 | 158 | 436 | 454 | 339 | 346 |
| 130 | 457 | 443 | 458 | 152 | 176 | 454 | 468 | 356 | 365 |
| 140 | 475 | 459 | 474 | 168 | 190 | 468 | 482 | 373 | 380 |
| 150 | 486 | 470 | 485 | 183 | 203 | 477 | 491 | 387 | 394 |
| 160 | 497 | 478 | 494 | 195 | 216 | 486 | 499 | 396 | 404 |
| 170 | 504 | 483 | 501 | 207 | 226 | 493 | 498 | 405 | 415 |
| 180 | 512 | 490 | 507 | 217 | 237 | 499 | 500 | 414 | 426 |
| 190 | 520 | 497 | 515 | 226 | 246 | 496 | 500 | 424 | 433 |
| 200 | 525 | 503 | 517 | 232 | 253 | 496 | 501 | 430 | 439 |
| 210 | 528 | 506 | 521 | 240 | 259 | 495 | 497 | 436 | 446 |
| 220 | 528 | 506 | 521 | 246 | 263 | 495 | 497 | 442 | 453 |
| 230 | 528 | 506 | 521 | 252 | 267 | 493 | 494 | 445 | 457 |
| 240 | 528 | 506 | 521 | 254 | 270 | 491 | 495 | 450 | 459 |
| 250 | 528 | 506 | 521 | 258 | 274 | 490 | 492 | 451 | 461 |
| 260 | 528 | 506 | 521 | 264 | 278 | 489 | 490 | 452 | 462 |
| 270 | 528 | 506 | 521 | 264 | 277 | 487 | 488 | 452 | 462 |
| 280 | 528 | 506 | 521 | 266 | 278 | 485 | 483 | 454 | 463 |
| 290 | 528 | 506 | 521 | 266 | 279 | 482 | 482 | 452 | 463 |
| 300 | 528 | 506 | 521 | 267 | 279 | 482 | 482 | 452 | 463 |
| 310 | 528 | 506 | 521 | 267 | 279 | 482 | 482 | 452 | 463 |
| 320 | 528 | 506 | 521 | 267 | 279 | 482 | 482 | 452 | 463 |
| 330 | 528 | 506 | 521 | 267 | 279 | 482 | 482 | 452 | 463 |
| 340 | 528 | 506 | 521 | 267 | 279 | 482 | 482 | 452 | 463 |
| 350 | 528 | 506 | 521 | 267 | 279 | 482 | 482 | 452 | 463 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | DPL_SBPS | DPL_SBPS | DPL_SBS | DPL_SBS | DPL_SBS | DPL_SBS | DFD_SBS | DFD_SBS | DFD_SBS |
|---|---|---|---|---|---|---|---|---|---|
| a_unit | 4331n_ | 4331p_ | 4341n_ | 4341nt | 4341p_ | 4341pt | 4343n_ | 4343nt | 4343p_ |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 1 | 1 | 1 | 2 | 4 | 0 | 0 | 1 |
| 30 | 19 | 36 | 30 | 39 | 51 | 60 | 13 | 17 | 24 |
| 40 | 82 | 111 | 103 | 112 | 139 | 148 | 56 | 64 | 87 |
| 50 | 151 | 187 | 180 | 185 | 220 | 227 | 120 | 127 | 158 |
| 60 | 212 | 249 | 245 | 252 | 286 | 293 | 184 | 189 | 218 |
| 70 | 267 | 300 | 302 | 307 | 334 | 346 | 242 | 247 | 269 |
| 80 | 311 | 340 | 342 | 350 | 373 | 385 | 289 | 292 | 310 |
| 90 | 342 | 369 | 375 | 387 | 400 | 416 | 330 | 335 | 343 |
| 100 | 366 | 390 | 405 | 416 | 422 | 439 | 362 | 372 | 372 |
| 110 | 390 | 408 | 424 | 439 | 439 | 456 | 389 | 399 | 394 |
| 120 | 406 | 422 | 444 | 459 | 452 | 471 | 411 | 424 | 414 |
| 130 | 418 | 432 | 458 | 474 | 461 | 482 | 432 | 443 | 430 |
| 140 | 429 | 441 | 467 | 485 | 467 | 491 | 448 | 461 | 446 |
| 150 | 439 | 448 | 476 | 493 | 474 | 495 | 462 | 474 | 458 |
| 160 | 446 | 453 | 485 | 500 | 476 | 497 | 472 | 485 | 470 |
| 170 | 451 | 457 | 492 | 505 | 479 | 500 | 482 | 495 | 472 |
| 180 | 453 | 459 | 492 | 505 | 479 | 500 | 487 | 501 | 480 |
| 190 | 454 | 458 | 492 | 505 | 479 | 500 | 495 | 507 | 486 |
| 200 | 458 | 458 | 492 | 505 | 479 | 500 | 502 | 515 | 491 |
| 210 | 460 | 461 | 492 | 505 | 479 | 500 | 506 | 518 | 495 |
| 220 | 461 | 463 | 492 | 505 | 479 | 500 | 508 | 518 | 498 |
| 230 | 463 | 463 | 492 | 505 | 479 | 500 | 511 | 524 | 502 |
| 240 | 464 | 463 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 250 | 463 | 463 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 260 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 270 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 280 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 290 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 300 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 310 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 320 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 330 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 340 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |
| 350 | 463 | 464 | 492 | 505 | 479 | 500 | 516 | 525 | 502 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | DFD_SBS | DPL_ESSF | DPL_ESSF | DPL_ICH | DPL_ICH | DFD_ICH | DFD_ICH | APL_ Salvage3 +IDF | APL_ Salvage3+ IDF |
|---|---|---|---|---|---|---|---|---|---|
| **a_unit** | **4343pt** | **4351n_** | **4351p_** | **4361p_** | **4361pt** | **4363p_** | **4363pt** | **4429n_** | **4429nt** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 30 | 30 | 7 | 17 | 18 | 24 | 7 | 11 | 0 | 0 |
| 40 | 97 | 42 | 68 | 71 | 80 | 39 | 46 | 1 | 2 |
| 50 | 164 | 96 | 134 | 140 | 148 | 92 | 101 | 7 | 12 |
| 60 | 224 | 151 | 191 | 203 | 211 | 144 | 152 | 22 | 29 |
| 70 | 276 | 203 | 240 | 253 | 262 | 191 | 198 | 41 | 49 |
| 80 | 321 | 246 | 280 | 296 | 306 | 230 | 238 | 65 | 73 |
| 90 | 354 | 285 | 314 | 333 | 343 | 264 | 270 | 89 | 98 |
| 100 | 383 | 315 | 342 | 358 | 370 | 294 | 303 | 112 | 119 |
| 110 | 407 | 338 | 359 | 378 | 392 | 317 | 326 | 132 | 139 |
| 120 | 428 | 357 | 374 | 394 | 409 | 337 | 345 | 151 | 158 |
| 130 | 446 | 372 | 383 | 408 | 423 | 352 | 362 | 166 | 173 |
| 140 | 462 | 384 | 393 | 420 | 436 | 365 | 377 | 180 | 186 |
| 150 | 474 | 395 | 404 | 430 | 446 | 376 | 389 | 194 | 199 |
| 160 | 483 | 404 | 410 | 435 | 455 | 387 | 400 | 204 | 209 |
| 170 | 490 | 412 | 416 | 444 | 462 | 397 | 410 | 213 | 219 |
| 180 | 495 | 418 | 418 | 447 | 466 | 407 | 420 | 222 | 227 |
| 190 | 504 | 419 | 422 | 453 | 471 | 414 | 427 | 230 | 236 |
| 200 | 507 | 424 | 425 | 454 | 472 | 418 | 432 | 236 | 242 |
| 210 | 510 | 424 | 425 | 457 | 475 | 423 | 435 | 242 | 248 |
| 220 | 513 | 428 | 428 | 455 | 474 | 425 | 439 | 247 | 252 |
| 230 | 517 | 428 | 427 | 455 | 474 | 430 | 441 | 251 | 258 |
| 240 | 517 | 431 | 429 | 454 | 473 | 431 | 444 | 254 | 259 |
| 250 | 517 | 431 | 431 | 456 | 474 | 433 | 447 | 254 | 263 |
| 260 | 517 | 433 | 431 | 456 | 471 | 435 | 447 | 257 | 265 |
| 270 | 517 | 433 | 433 | 456 | 470 | 437 | 449 | 260 | 267 |
| 280 | 517 | 434 | 431 | 456 | 469 | 437 | 450 | 264 | 271 |
| 290 | 517 | 435 | 433 | 454 | 470 | 438 | 452 | 264 | 274 |
| 300 | 517 | 435 | 433 | 454 | 470 | 438 | 452 | 267 | 275 |
| 310 | 517 | 435 | 433 | 454 | 470 | 438 | 452 | 267 | 275 |
| 320 | 517 | 435 | 433 | 454 | 470 | 438 | 452 | 267 | 275 |
| 330 | 517 | 435 | 433 | 454 | 470 | 438 | 452 | 267 | 275 |
| 340 | 517 | 435 | 433 | 454 | 470 | 438 | 452 | 267 | 275 |
| 350 | 517 | 435 | 433 | 454 | 470 | 438 | 452 | 267 | 275 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-41. Volume estimates for managed stands (cubic metres/hectare)*

| Label | APL_ Salvage3+ SBPS | APL_ Salvage3+ SBPS | BPL_ Salvage3+ IDF | BPL_ Salvage3+ IDF | BPL_ Salvage3+ SBPS | BPL_ Salvage3+ SBPS |
|---|---|---|---|---|---|---|
| **a_unit** | **4439n_** | **4439p_** | **4529n_** | **4529nt** | **4539n_** | **4539p_** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 1 | 2 | 1 | 1 | 0 | 1 |
| 50 | 12 | 17 | 4 | 8 | 4 | 8 |
| 60 | 30 | 39 | 15 | 22 | 15 | 21 |
| 70 | 53 | 69 | 33 | 41 | 31 | 40 |
| 80 | 79 | 99 | 52 | 61 | 50 | 66 |
| 90 | 106 | 130 | 74 | 83 | 73 | 90 |
| 100 | 129 | 155 | 96 | 104 | 95 | 115 |
| 110 | 151 | 179 | 115 | 123 | 115 | 138 |
| 120 | 170 | 198 | 134 | 140 | 131 | 157 |
| 130 | 185 | 216 | 150 | 156 | 149 | 176 |
| 140 | 201 | 231 | 163 | 169 | 161 | 190 |
| 150 | 211 | 243 | 175 | 181 | 173 | 204 |
| 160 | 222 | 256 | 187 | 193 | 186 | 216 |
| 170 | 232 | 266 | 197 | 201 | 194 | 228 |
| 180 | 239 | 277 | 204 | 211 | 203 | 238 |
| 190 | 246 | 281 | 213 | 218 | 210 | 245 |
| 200 | 253 | 287 | 219 | 225 | 216 | 252 |
| 210 | 258 | 292 | 225 | 231 | 221 | 258 |
| 220 | 263 | 297 | 229 | 236 | 227 | 262 |
| 230 | 266 | 299 | 235 | 241 | 230 | 266 |
| 240 | 268 | 299 | 239 | 245 | 237 | 271 |
| 250 | 271 | 305 | 243 | 249 | 240 | 274 |
| 260 | 274 | 307 | 246 | 250 | 242 | 278 |
| 270 | 277 | 309 | 244 | 253 | 244 | 278 |
| 280 | 278 | 312 | 246 | 254 | 243 | 277 |
| 290 | 283 | 315 | 247 | 255 | 245 | 278 |
| 300 | 285 | 315 | 247 | 254 | 245 | 278 |
| 310 | 285 | 315 | 247 | 254 | 245 | 278 |
| 320 | 285 | 315 | 247 | 254 | 245 | 278 |
| 330 | 285 | 315 | 247 | 254 | 245 | 278 |
| 340 | 285 | 315 | 247 | 254 | 245 | 278 |
| 350 | 285 | 315 | 247 | 254 | 245 | 278 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

# A.5 Volume Estimates

## A.5.3 Volume estimates for partially harvested stands

The variable density yield prediction (VDYP) model, Version 6.5a developed and supported by the British Columbia Ministry of Forests, Resources Inventory Branch, was used to estimate timber volumes for partially harvested stands. Table A-42. shows the volume estimates by analysis unit for partially harvested stands. See Section A.4.7 "Silvicultural systems" for a complete description of partial harvesting practices. The expected changes to productivity shown in Table A-28. are incorporated into the volumes shown here.

*Table A-42. Volume estimates for partially harvested stands (cubic metres/hectare)*

| Label | AFD_dry | AFD_dry Log | AMDWR-FirHi | AMDWR-FirHiLog | AMDWR-FirLo | AMDWR-FirLoLog | BFD_dry |
|---|---|---|---|---|---|---|---|
| **a_unit** | **9113** | **9114** | **9175** | **9176** | **9185** | **9186** | **9213** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 2 | 1 | 2 | 0 | 0 | 1 |
| 50 | 2 | 6 | 3 | 9 | 0 | 0 | 10 |
| 60 | 8 | 14 | 13 | 23 | 1 | 1 | 27 |
| 70 | 20 | 27 | 29 | 42 | 8 | 5 | 47 |
| 80 | 34 | 42 | 44 | 60 | 20 | 10 | 67 |
| 90 | 48 | 43 | 60 | 79 | 32 | 17 | 86 |
| 100 | 62 | 54 | 75 | 96 | 44 | 23 | 105 |
| 110 | 75 | 65 | 90 | 113 | 56 | 29 | 123 |
| 120 | 87 | 76 | 103 | 128 | 66 | 35 | 139 |
| 130 | 99 | 85 | 115 | 130 | 76 | 41 | 155 |
| 140 | 109 | 94 | 127 | 134 | 85 | 47 | 168 |
| 150 | 118 | 101 | 137 | 143 | 94 | 52 | 181 |
| 160 | 127 | 107 | 146 | 151 | 101 | 56 | 191 |
| 170 | 134 | 113 | 154 | 159 | 108 | 60 | 200 |
| 180 | 141 | 118 | 162 | 165 | 114 | 64 | 209 |
| 190 | 148 | 123 | 170 | 171 | 120 | 67 | 218 |
| 200 | 154 | 128 | 177 | 178 | 127 | 70 | 226 |
| 210 | 161 | 132 | 185 | 184 | 132 | 74 | 234 |
| 220 | 167 | 137 | 191 | 189 | 138 | 77 | 242 |
| 230 | 173 | 141 | 198 | 195 | 144 | 80 | 249 |
| 240 | 178 | 145 | 204 | 200 | 149 | 82 | 256 |
| 250 | 183 | 149 | 210 | 205 | 153 | 85 | 263 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

## A.5 Volume Estimates

*Table A-42. Volume estimates for partially harvested stands (cubic metres/hectare)*

| Label | BFD_dry Log | BMDWR-FirHi | BMDWR-FirHiLog | BMDWR-FirLo | BMDWR-FirLoLog | DMDWR-FirHi | DMDWR-FirHiLog |
|---|---|---|---|---|---|---|---|
| **a_unit** | **9214** | **9275** | **9276** | **9285** | **9286** | **9375** | **9376** |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 4 | 2 |
| 40 | 3 | 6 | 9 | 0 | 0 | 31 | 29 |
| 50 | 11 | 22 | 30 | 3 | 1 | 67 | 64 |
| 60 | 24 | 45 | 54 | 11 | 6 | 104 | 100 |
| 70 | 39 | 69 | 79 | 24 | 17 | 139 | 136 |
| 80 | 56 | 92 | 103 | 40 | 23 | 172 | 170 |
| 90 | 73 | 114 | 126 | 55 | 33 | 203 | 201 |
| 100 | 78 | 135 | 148 | 70 | 44 | 231 | 210 |
| 110 | 92 | 156 | 170 | 85 | 54 | 256 | 222 |
| 120 | 105 | 174 | 189 | 98 | 63 | 278 | 242 |
| 130 | 116 | 191 | 191 | 110 | 72 | 298 | 261 |
| 140 | 127 | 206 | 205 | 121 | 79 | 315 | 278 |
| 150 | 136 | 220 | 218 | 131 | 86 | 331 | 293 |
| 160 | 144 | 232 | 228 | 140 | 93 | 344 | 306 |
| 170 | 151 | 242 | 238 | 148 | 98 | 356 | 318 |
| 180 | 157 | 252 | 247 | 156 | 104 | 367 | 330 |
| 190 | 163 | 262 | 255 | 163 | 109 | 376 | 340 |
| 200 | 169 | 271 | 263 | 170 | 113 | 386 | 351 |
| 210 | 174 | 280 | 270 | 178 | 118 | 395 | 360 |
| 220 | 179 | 289 | 277 | 184 | 122 | 404 | 370 |
| 230 | 185 | 297 | 284 | 191 | 127 | 412 | 378 |
| 240 | 189 | 305 | 291 | 197 | 131 | 420 | 387 |
| 250 | 194 | 312 | 297 | 203 | 135 | 427 | 395 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

*(continued)*

# A.5 Volume Estimates

*Table A-42. Volume estimates for partially harvested stands (cubic metres/hectare) (concluded)*

| Label | DMDWR-FirLo | DMDWR-FirLoLog | DCaribou_E_ | ACaribou_Wa | ACaribou_Wt |
|---|---|---|---|---|---|
| **a_unit** | **9385** | **9386** | **9700** | **9800** | **9900** |
| 10 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 1 | 0 | 0 |
| 40 | 16 | 5 | 7 | 0 | 2 |
| 50 | 47 | 15 | 25 | 2 | 11 |
| 60 | 79 | 31 | 60 | 21 | 37 |
| 70 | 110 | 48 | 102 | 61 | 71 |
| 80 | 139 | 63 | 143 | 110 | 81 |
| 90 | 167 | 79 | 150 | 118 | 91 |
| 100 | 194 | 109 | 160 | 126 | 101 |
| 110 | 219 | 125 | 170 | 134 | 111 |
| 120 | 241 | 139 | 180 | 142 | 121 |
| 130 | 261 | 152 | 190 | 150 | 131 |
| 140 | 279 | 162 | 200 | 158 | 142 |
| 150 | 294 | 171 | 205 | 164 | 150 |
| 160 | 307 | 179 | 215 | 166 | 157 |
| 170 | 319 | 185 | 226 | 173 | 162 |
| 180 | 329 | 191 | 237 | 178 | 165 |
| 190 | 339 | 197 | 247 | 181 | 165 |
| 200 | 349 | 203 | 256 | 186 | 168 |
| 210 | 358 | 208 | 265 | 190 | 170 |
| 220 | 367 | 213 | 274 | 195 | 173 |
| 230 | 375 | 218 | 282 | 199 | 175 |
| 240 | 383 | 222 | 290 | 202 | 177 |
| 250 | 390 | 226 | 297 | 206 | 180 |
| 260 |  |  | 300 | 209 | 181 |
| 270 |  |  | 302 | 212 | 183 |
| 280 |  |  | 305 | 214 | 185 |
| 290 |  |  | 307 | 217 | 186 |
| 300 |  |  | 309 | 219 | 187 |
| 310 |  |  | 311 | 221 | 188 |
| 320 |  |  | 313 | 222 | 189 |
| 330 |  |  | 314 | 224 | 190 |
| 340 |  |  | 316 | 225 | 190 |
| 350 |  |  | 317 | 226 | 190 |

Note: First letter of the label stands for forest district: A - Chilcotin, B - Williams Lake, D - Horsefly.

# Appendix B

# Socio-Economic Analysis Background Information

## B.1 Limitations of Economic Analysis

The socio-economic analysis portion of this report identifies employment and income impacts, changes in government revenues, and community impacts as a result of changes in the TSA's harvest levels over time. Some of the assumptions used in this report are as follows:

- Employment multiplier — employment multipliers are used to estimate indirect and induced employment impacts of a change in direct industry activity. The calculation of employment multipliers is based on analytical assumptions and data collected at a specific time period. The multipliers reflect industry and employment conditions at that time and may not accurately reflect industry and employment conditions in the future.
- Employment coefficient — employment coefficients are ratios of person-years of employment per 1000 cubic metres of timber harvested. These ratios are used to estimate employment levels associated with alternative harvest rates. This method of analysis assumes that the industry structure will be the same in the future as it is today. While reasonably accurate in the short term, employment coefficients may change in the future due to changes in market conditions, product mix or production technologies.
- Timing of impacts — employment impacts are shown to occur simultaneously with a change in the harvest level. While this assumption is reasonably accurate for the harvesting sub-sector, employment estimates for the silviculture and timber processing sub-sectors may not be as coincidental. As well, indirect and induced impacts tend to occur over a longer period, as levels of business and consumer spending adjust to changes in harvest levels.
- Operating thresholds of mills — it is unlikely that impacts on timber processing employment due to changes in harvest levels will be in direct proportion to the harvest changes (i.e., a 10% change in harvest may not lead to a 10% change in timber processing employment). Impacts on timber processing employment are more likely to occur step-wise related to operating thresholds of mills. For example, if a mill's timber supply is reduced, its operating threshold is reached when the decrease in timber supply causes it to lay off a shift of workers or to close the mill, either temporarily or permanently. Conversely, if the timber supply to the mill is increased, a processing threshold is reached when the mill has to decide whether to add another shift of workers or new capacity to process the increase in timber supply. In both cases, the per cent change in employment in the mill would probably differ from the per cent change in the timber processed. Because mills have many different operating configurations, accurately predicting an individual mill's operating threshold is impossible. As a result, impact figures pertaining to employment in timber processing are best interpreted as size of change rather than as precise changes in employment levels.
- Government expenditures — provincial government expenditures are more related to government policy and population levels than to industry activity. As such, expenditures on education, health care and other government services are assumed to remain unchanged despite changes to the harvest level and subsequent changes in government revenues from the forestry sector. However, provincial government expenditures would likely change if a community's population significantly changes. This would amplify the community impacts of losses or gains in forestry sector jobs.
- Proportional harvest reductions — harvest reductions are assumed to be proportionately distributed among all licensees and all forms of tenure within the TSA.

# B.2 Economic Impact Analysis Methodology

**Data sources**

Data for the socio-economic analysis were obtained from several sources. Harvest volume and stumpage data are from the Ministry of Forests. Timber flow and employment data are from responses to questionnaires that were sent to licensees, operators and processing facilities in the TSA. Other general economic data are from British Columbia Statistics, the Ministry of Finance, Statistics Canada and local communities. Estimates of taxes paid by the forest industry are from PricewaterhouseCoopers.

**Person-year of employment**

The unit of measurement for employment is a person-year. A person-year of employment is defined as a full-time job, which lasts at least 180 days per year. Part-time jobs were converted to equivalent full-time person-years of employment.

To estimate employment and income impacts associated with changes in TSA timber harvest levels, the forestry sector was divided into three sub-sectors:

1. harvesting;
2. silviculture; and
3. timber processing.

Employment and income impacts were estimated in several steps. The first step was to assess current activity in each of the three sub-sectors. Then, indirect and induced employment and employment income impacts were estimated, using data from Ministry of Finance and Statistics Canada. Next, employment coefficients were calculated and then applied to the base case harvest forecast. Other indicators of the forestry sector's contribution to the provincial economy, such as government revenues and industry taxes were also calculated, using Ministry of Forests stumpage estimates and other data sources.

**Employment — harvesting**

Direct employment in harvesting consists of all woodlands-related jobs including harvesting, log salvage, planning and administration functions and log transportation. The employment multipliers used in this analysis define activities such as road building or maintenance work as indirect employment rather than direct employment because the forestry sector and other basic sectors can purchase these services.

Data on employment, place of residence and timber flows were obtained from responses to questionnaires that were sent to licensees and operators in the TSA. The information was then used to estimate employment averages associated with harvest changes and the proportion of residents *versus* non-residents who work in the TSA.

Two estimates of direct employment in harvesting were calculated:

1. TSA direct employment in harvesting consists of employees who are engaged in harvesting and related activities within the TSA and who reside in communities within the TSA; and
2. Provincial direct employment in harvesting consists of employees who are engaged in harvesting, as above, plus those workers who reside outside the TSA, but who come to the TSA to work in harvesting and harvesting-related activities.

The estimates of TSA and provincial direct employment in harvesting were used to calculate employment coefficients per 1000 cubic metres. These employment coefficients were then used to estimate harvesting employment associated with the different harvest levels in the base case forecast.

**Employment — silviculture**

Silviculture employment consists of all basic and intensive reforestation activities, including surveys, site preparation, planting, fertilization, pruning and spacing. Silviculture employment data were collected from the Ministry of Forests and licensees whose tenures require post-harvest silviculture work. Most silviculture work is seasonal and silviculture employees usually only work part-time during the year. Because of this, information on silviculture employment was converted into equivalent full-time person-years of employment. Respondents were also asked to estimate the percentage of their silviculture employees who resided within the TSA and outside the TSA.

As with the harvesting sub-sector, two estimates of direct employment in silviculture were calculated: one for the TSA and another for the province. These employment figures were used to calculate employment coefficients for silviculture employment in the same manner as the employment coefficients for harvest employment.

**Employment — timber processing**

Information about employment, production and sources of timber was gathered from mills. Information was also gathered as to whether timber harvested from the TSA was processed within the TSA or outside the TSA. This information indicates the degree of dependence the mills have on timber harvested within the TSA. To estimate the share of processing employment supported by TSA timber, mill employment was prorated by the relative contribution of timber from the TSA to a mill's total timber requirement. For example, if 80% of a plant's timber supply is from the harvest of the TSA, then 80% of the employment in the plant would be attributable to the TSA harvest. Employment figures were also adjusted to reflect the residences of workers (i.e., those who lived within the TSA and those who lived outside the TSA). Employment in timber processing that is supported by chip by-products from milling operations was also similarly estimated.

As with the harvesting sub-sector, two estimates of direct employment in timber processing were calculated: one for the TSA and another for the province. These employment figures were used to calculate employment coefficients for timber processing employment in the same manner as the employment coefficients for harvest employment.

**Indirect and induced employment estimates**

Indirect employment in the forestry sector refers to those who provide goods and services to firms directly engaged in the basic forestry sector (for example, those who build or maintain road for log transport). Induced employment refers to those who provide the goods and services purchased by employees who are directly and indirectly engaged in the industry (for example, those who work in retail outlets). Indirect and induced employment figures were calculated using TSA and provincial employment multipliers developed by the Ministry of Finance.

## B.2 Economic Impact Analysis Methodology

Two sets of employment multipliers were calculated for this report: a migration multiplier and a no-migration multiplier. The migration multipliers assume that displaced workers will leave the region, reducing total income in the region by their full wage. The no-migration multipliers assume that displaced workers remain in the area, at least in the short term, and unemployment and other social safety net payments temporarily offset some of the income loss. Using the no-migration multipliers diminishes the degree of induced impacts associated with a change in direct employment.

The TSA and provincial employment multipliers used in the Williams Lake TSA analysis are shown in Table B-1.

*Table B-1. Employment multipliers — Williams Lake TSA*

| Forestry sub-sector | Williams Lake TSA migration multiplier | Williams Lake TSA no-migration multiplier | Provincial (interior) migration multiplier | Provincial (interior) no-migration multiplier |
|---|---|---|---|---|
| Harvesting | 1.49 | 1.29 | 2.14 | 1.80 |
| Solid wood processing | 1.58 | 1.33 | 2.29 | 1.93 |
| Plywood | 1.58 | 1.33 | 1.93 | 1.64 |
| Pulp | N/A | N/A | 3.02 | 2.48 |

Sources: Ministry of Finance and Corporate Relations. 1999. The 1996 forest district tables.

Ministry of Finance and Corporate Relations. 1996. A provincial impact estimation procedure for the British Columbia forestry sector.

## B.2 Economic Impact Analysis Methodology

**Estimates of employment income**

Employment income was calculated using average income estimates for workers in the forest industry. Based on Statistics Canada data, the weighted average annual pre-tax income (less benefits) for forestry sector workers in 2000 was:

$46,612 for those working in logging and forestry services;

$42,438 for those working in solid wood manufacturing; and

$56,254 for those working in pulp and paper mills.

Those in indirect and induced occupations earned approximately $31,408. Income taxes were calculated based on marginal tax rates of 23–28% with one-third of the total income tax paid accruing to the province.

**Employment estimates of alternate timber supply levels**

To estimate employment generated by alternative timber supplies, the forecast harvest level is multiplied by the calculated employment coefficients. Note that employment coefficients are based on current industry productivity, harvest practices and forest management assumptions and will not likely reflect industry operating conditions in future years. Therefore, the employment estimates should be viewed as indicators of size of change rather than as precise estimates of changes in employment levels.

# B.2 Economic Impact Analysis Methodology

### Provincial government revenues

Except for stumpage, royalty and rents, which are specific to the TSA, provincial government revenue impacts were estimated by using industry averages. Revenues per 1000 cubic metres of harvest, expressed as dollars per 1000 cubic metres, were calculated and applied to the harvest levels in the base case forecast in a manner similar to how employment impacts were estimated (Table B-2.).

*Table B-2. Estimates of provincial government revenues — Williams Lake TSA*

| | Average annual revenue 1998-2000 ($ millions) | Revenue ($ per '000s m³) |
|---|---|---|
| Stumpage and related payments[a] | 51.02 | 13,535 |
| Forest industry taxes[b] | 29.14 | 7,731 |
| Employee income tax[c] | 22.97 | 6,093 |
| Total | 103.13 | 27,359 |

(a) Source: Ministry of Forests, Revenue Branch. Based on average annual harvest of 3 769 250 cubic metres.

(b) Based on estimates by PricewaterhouseCoopers. Includes taxes for logging, corporate income, corporate capital, sales, property and electricity.

(c) Estimated from Canada Customs and Revenue Agency. Income tax includes only the provincial share of income taxes paid.